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THE PRESENT PROBLEMS OF GEOGRAPHY.*

By HUGH ROBERT MILL, D.Sc., LL.D.

The present problems of a science may, I hope, be viewed as those problems the solution of which at the present time is most urgent and appears most promising. Were present problems held to include the whole penumbra of our ignorance, I at least have neither the desire nor the competence to discourse upon them. So much has been written on the problems of geography in recent years that a detailed summary of the existing literature would be a ponderous work, and afford much dull and contradictory reading. I cannot even attempt to associate different views of the problems of geography with the names of their leading exponents, though, perhaps, if I were to do so, I should quote with almost entire approval the masterly address recently delivered to the American Association for the Advancement of Science by Prof. W. M. Davis.

Believing that every geographer should approach such a question as this by the avenue of his own experience, I offer a frankly personal opinion, the outcome of such study, research, and intercourse with kindred workers as have been possible to me during the last twenty years. The views I hold may not be representative of European, perhaps not even of British, geographical opinion, except in so far as they are the result of assimilating, more or less consciously, the writings and teachings of geographical leaders in all countries, retaining congenial factors, and modifying or rejecting those which were foreign to the workings of my own partially instructed mind.

* An address delivered to the International Congress of Arts and Sciences at St. Louis on September 22, 1904.

The history of every branch of science teaches that time works changes in the nature and the value of the problems of the hour. In successive ages the waves of existing knowledge made inroads upon the shores of ignorance at different points. For one generation they seem to have been setting, with all their force, against some one selected point; in the next they are encroaching elsewhere, the former problem left, it may be, imperfectly solved; but gradually the area of the unknown is being reduced on every side, however irregularly.

In the beginning of geography, the problem before all others was the figure of the Earth. Scientific progress, not in geography alone, but in all science, depended on the discovery of the truth as to form. No sooner was the sphericity of the Earth established than two fresh problems sprang to the front, neither of them new, for both existed from the first—the fixing of position, and the measurement of the size of the Earth. Geography, and science as a whole, progressed by the failures, as well as by the successes, of the pioneers who struggled for centuries with these problems. Latitude was a simple matter, theoretically no problem at all, but a direct deduction from the Earth's form, though its determination was practically delayed by difficulties of a mechanical kind. The problem of the longitude was far more serious, and bulks largely in the history of science. Pending their solution, the estimates of size were rough guesses; had they been more accurate, it is doubtful if Columbus could have persuaded any sane sailor to accompany him on his westward voyage to India, the coast of which he was not surprised to find so near to Spain as the Caribbean sea.

After latitude could be fixed to a nicety, and longitude worked out in certain circumstances with nearly equal accuracy, the size of the Earth was determined within a small limit of error, and the problem of geography shifted to detailed discovery. This phase lasted so long that even now it hardly excites surprise to see an article, or to open a volume, on the history of geography, which turns out to be a narrative of the progress of discovery. Perhaps British geographers, more than others, were prone to this error, and for a time the country foremost in modern discovery ran some risk of falling to the rear in real geography.

It is not so paradoxical as it seems to say that the chief problem of geography at present is the definition of geography. Some learned men have said within living memory, and many have thought, that geography is not a science at all, that it is without unity, without a central theory, that it is a mere agglomerate of scraps of miscellaneous information regarding matters which are dealt with scientifically by astronomers, geologists, botanists, anthropologists, and others. Geography is not so circumstanced. Although its true position has only recently been recovered from oblivion, it is a science, and one of long standing.

I have said before,* and I may repeat, because I can say it no

* British Assoc. Reports—Presidential Address in Section E. Glasgow, 1901.

better, that modern geography has developed by a recognizable continuity of change from century to century. I am inclined to give more weight than others have done to the remarkable treatise of Dr. Nathanael Carpenter, of Exeter College, Oxford, published in 1625, as a stage in the growth of geographical thought and theory. The striking feature of Carpenter's book is the practical assertion of the claims of common sense in dealing with questions which superstition and tradition had previously influenced. Varenius, who died at the age of twenty-eight, published in 1650 a single small volume, which is a model of conciseness of expression and logical arrangement well worthy even now of literal translation into English. From several points in its arrangement, I am inclined to believe that he was influenced by Carpenter's work. So highly was Varenius's book thought of at the time that Sir Isaac Newton brought out an annotated Latin edition at Cambridge in 1672. The opening definition as rendered in the English translation of 1733 (a work largely spoilt by stupid notes and interpolations) runs—

"Geography is that part of *mixed mathematics* which explains the state of the Earth and of its parts, depending on quantity, viz. its figure, place, magnitude, and motion with the celestial appearances, etc. By some it is taken in too limited a sense, for a bare description of the several countries; and by others too extensively, who along with such a description would have their political constitution."

Varenius produced a framework of Physical Geography capable of including new facts of discovery as they arose; and it is no wonder that his work, although but a part, ruled unchallenged as the standard text-book of pure geography for more than a century. He laid stress on the causes and effects of phenomena as well as the mere fact of their occurrence, and he clearly recognized the influence upon different distributions of the vertical relief of the land. He did not treat of human relations in geography, but, under protest, gave a scheme for discussing them as a concession to popular demands.

As Isaac Newton, the mathematician, had turned his attention to geography at Cambridge in the earlier part of the eighteenth century, so Immanuel Kant, the philosopher, lectured on the same subject at Königsberg in the later part. The science of geography he considered to be fundamentally physical, but physical geography formed the introduction and key to all other possible geographies, of which he enumerated five: *mathematical*, concerned with the form, size, and movements of the Earth and its place in the solar system; *moral*, taking account of the customs and characters of mankind according to their physical surroundings; *political*, concerning the divisions of the land into the territories of organized governments; *mercantile*, or, as we now call it, commercial geography; and *theological*, which took account of the distribution of religions. It is not so much the cleavage of

geography into five branches, all springing from physical geography like the fingers from a hand, which is worthy of remark, but rather the recognition of the interaction of the conditions of physical geography with all other geographical conditions. The scheme of geography thus acquired unity and flexibility such as it had not previously attained, but Kant's views have never received wide recognition. If his geographical lectures have been translated, no English or French edition has come under my notice; and such currency as they obtained in Germany was checked by the more concrete and brilliant work of Humboldt, and the teleological system elaborated in overwhelming detail by Ritter.

Ritter's views were substantially those of Paley. The world, he found, fitted its inhabitants so well that it was obviously made for them down to the minutest detail. The theory was one peculiarly acceptable in the early decades of the nineteenth century, and it had the immensely important result of leading men to view the Earth as a great unit with all its parts co-ordinated to one end. It gave a philosophical, we may even say a theological, character to the study of geography.

Kant had also pointed to unity, but from another side, that of evolution. It was not until after Charles Darwin had fully restored the doctrine of evolution to modern thought that it was forced upon thinking men that the fitness of the Earth to its inhabitants might result, not from its being made for them, but from their having been shaped by it. The influence of terrestrial environment upon the life of a people may have been exaggerated by some writers—by Buckle, in his 'History of Civilization,' for example—but it is certain that this influence is a potent one. The relation between the forms of the solid crust of the Earth and all the other phenomena of the surface constitutes the very essence of geography.

It is a fact that many branches of the study of the Earth's surface which were included in the Cosmography of the sixteenth century, the Physiography of Linnæus, the Physical Geography of Humboldt, and perhaps even the *Erdkunde* of Ritter, have been elaborated by specialists into studies which, for their full comprehension, require the whole attention of the student; but it does not follow that these specializations fully occupy the place of geography, for that place is to co-ordinate and correlate all the special facts concerned so that they may throw light on the plan and the processes of the Earth and its inhabitants. This was clear to Carpenter in 1625, though it has been almost forgotten since.

The principles of geography on which its claims to status as a science rest are generally agreed upon by modern geographers, though with such variations as arise from differences of standpoint and of mental process. The evolutionary idea is unifying geography as it has

unified biology, and the whole complicated subject may be presented as the result of continuous progressive change brought about and guided by the influence of external conditions. It is impossible to discuss the present problems of geography without once more recapitulating the permanent principles.

The science of geography is, of course, based on the mathematical properties of a rotating sphere; but there is force in Kant's classification, which subordinated mathematical to physical geography. The vertical relief of the Earth's crust shows us the grand and fundamental contrast between the oceanic hollow and the continental ridges; and the hydrosphere is so guided by gravitation as to fill the hollow and rise upon the slopes of the ridges to a height depending on its volume, thus introducing the great superficial separation into land and sea. The movements of the water of the ocean are guided in every particular by the relief of the sea-bed and the configuration of the coast-lines. Even the distribution of the atmosphere over the Earth's surface is affected by the relief of the crust, the direction and force of the winds being largely dominated by the form of the land over which they blow. The different physical constitution of land, water, and air, especially the great difference between the specific heat and conductivity or diathermancy of the three, causes changes in the distribution of the sun's heat, and as a result the simple climatic zones and rhythmic seasons of the mathematical sphere are distorted out of all their primitive simplicity. The whole irregular distribution of rainfall and aridity, of permanent, seasonal, and variable winds, of sea climate and land climate, is the resultant of the guiding action of land forms on the air and water currents, disturbed in this way from their primitive theoretical circulation. So far we see the surface forms of the Earth, themselves largely the result of the action of climatic forces, and constantly undergoing change in a definite direction, controlling the two great systems of fluid circulation. These in turn control the distribution of plants and animals, in conjunction with the direct action of surface relief, the natural regions and belts of climate dictating the distribution of living creatures. A more complicated state of things is found when the combined physical and biological environment is studied in its incidence on the distribution of the human race, the areas of human settlement, and the lines of human communications. The complication arises partly from the fact that each of the successive earlier environments acts both independently and concurrently; but the difficulty is in greater degree due to the circumstance that man alone among animals is capable of reacting on his environment and deliberately modifying the conditions which control him.

I have said before, and I repeat now, that the glory of geography as a science, the fascination of geography as a study, and the value of geography in practical affairs, arise from the recognition of this unifying influence of surface relief in controlling, though in the higher

developments rather by suggestion than dictation, the incidence of every mobile distribution on the Earth's surface. I am inclined, in the light of these views, to put forward a definition of geography which I think may be accepted in principle, if not in phrase, by most of the class called by Prof. Davis "mature geographers."

It runs, *Geography is the science which deals with the forms of relief of the Earth's crust, and with the influence which these forms exercise on the distribution of all other phenomena.*

The old pigeon-hole view of human knowledge is now happily discredited and recognized as useless, save perhaps by some Rip van Winkles of science, who concern themselves more with names than things, and would placidly misconceive the facts of nature to fit the framework of their accepted theories. High specialization is necessary to progress, but only as a phase of a working life, not as the whole purpose of a whole man.

It is convenient and often profitable for a man of science to have a recognized label, but it seems to me that important advances are to be made by cultivating those corners of the field of knowledge which lie between the patches where the labelled specialists toil in recognized and respected supremacy. It has been so habitual to classify the man of science by what he works in, that it almost requires an effort to see that the way in which he works is of greater determinative importance. Thus the scientific geographer is apt to find no place in the stereotyped classification, and his work may be lost sight of on that account. Should he dwell on latitude and longitude, the astronomer smiles pityingly; if he looks at rocks, the geologist claims that department; if he turns to plants, the botanist, with the ecologist behind him, is ready to warn him off; and so with other specialists. But the mature geographer seeks none of the territory, and hankers after none of the goldfields belonging to other recognized investigators. He works with the material they have already elaborated, and carries the process a step further, like the goldsmith handling the finished products of the metallurgist and the miner.

The present problems of geography seem to me to be of two kinds: the first minor and preliminary, the completion of the unsolved and partially solved problems of the past; the second ultimate and essential, dealing with the great problem on the solution of which the whole future of the science rests.

The residual problems inherited from the past represent the work which should have been done by our predecessors, but, not having been done at the right time, remains now to bar our progress. It has to do only with ascertaining and accurately recording facts, and involves infinite labour, but comparatively little geographical thought.

To begin with, the ground should be cleared by wiping off the globe the words *terra incognita*. Such unknown parts of the Earth now cling

about the poles alone, and that they should even do this is something of a disgrace. If common terrestrial globes were pivoted on equatorial points, so that the polar areas were not covered with brass mountings, the sight of the bare patches would perhaps have been so galling to the pride of humanity that they would long since have been filled in in detail. Again and again, and never more splendidly than in recent years, polar explorers have shown courage and perseverance, and have cheerfully encountered hardships enough to have enabled them to reach the poles, and they would have done so, not once, but many times, were it not for the want of money. Of course, all polar explorers have not been competent for the task they undertook, but most of the leaders, if they had had more powerful ships, more coal, more stores, more dogs—and sometimes if they had had fewer men—could have solved these perennial problems of exploration. With a competent man in command—and competent men abound—a sufficiency of money is all that is required. A million dollars judiciously spent would open the way to the north pole, a few millions would reach the south pole; but far more than this has been spent in vain because the money was doled out in small sums at long intervals, sometimes to explorers with no real call to the quest, and working in accordance with no scientific plan.

The grand journeys over the polar ice of Nansen, Peary, and Cagni in the north, and of Scott and his company in the south, promise well for an early solution of this particular problem.

The other residual problems of exploration and survey are in the same case. If those who control money saw it to be their duty to solve them, they would all be solved, not in a year, but in due time. Though a great deal of exploration remains to do, the day of the ignorant explorer is done. The person who penetrates a little-known country in search of adventures or sport, or in order to go where no one of his colour or creed had been before, is, from the geographical point of view, a useless wanderer; and if he be a harmless wanderer, the true explorer who may follow in his footsteps is uncommonly fortunate. Exploration now requires, not the pioneer, but the surveyor and the student.

The map of the world ought to be completed, and it is the duty and, I believe, the interest of every country to complete at least that portion which includes its own territory. An imperial policy which ignores such an imperial responsibility is a thing of words, and not of deeds. Unsurveyed and unmapped territory is a danger, as well as a disgrace, to the country possessing it, and it would hardly be too much to say that boundary disputes would be unknown if new lands were mapped before their mineral wealth is discovered. The degree of detail required in any survey depends upon the importance of the region. The desideratum is not a large-scale map of every uninhabited island, but a map of the whole Earth's surface on the same scale, which for the present may be

a small one, and might very well be that of 1 : 1,000,000 proposed by Prof. Penck, and now being carried into effect for the surveyed portions of the land. Such a map ought to include sub-aqueous as well as sub-aërial features, and when completed it would form a solid basis for the full discussion of many problems which at present can only be touched upon in a detached and unsatisfactory manner. The first problem which it would solve is the measurement of the volume of the oceanic waters and of the emergent land, so that the mean depth of the oceans and the mean heights of the continents might be exactly determined. This would involve, besides the horizontal surveys, a vertical survey of considerable accuracy. At sea the vertical element is easily found, and the depths measured by surveying and exploring vessels in recent years are very accurate. They must, however, be made much more numerous. On land, outside the trigonometrically surveyed and spirit-levelled countries, the vertical features are still most unsatisfactorily delineated. Barometric determinations, even when made with mercurial barometers or boiling-point thermometers, are uncertain at the best, while when made with aneroids they afford only the roughest approximations to the truth. Where levelling is impracticable, angular measurements of prominent heights, at least, should be insisted on as an absolute necessity in every survey.

When a map of the whole surface of the Earth on the scale of 1 : 1,000,000 is completed, we may consider the residual problems as solved. This is far from being the case as yet, and in the present circumstances the most useful work that the geographical societies of the world could do would be to secure the completion of explorational surveys to that scale. The system of instruction for travellers established by the Royal Geographical Society has equipped a large number of explorers and colonial officials as expert surveyors, and the result is now being felt in every quarter of the globe. This is not the highest geographical work, but merely preliminary and preparatory; yet progress is checked, if not barred, until it is accomplished. The map of one to a million is not to be viewed as an end in itself; nevertheless, its completion will mark an era, the accomplishment of the small-scale survey of the globe, and permit of fresh advances.

Money could solve the last of the problems of exploration, but when we come to problems of the second category we enter a region of pure science, where money becomes a minor consideration. The acquisition of knowledge is a simple process, for which multitudes have a natural aptitude; but the co-ordination of knowledge and its advancement are very different matters. The difference is more marked in the case of geography than in geology or chemistry or physics, for, in English-speaking countries at least, the training of geographers is in its infancy, whilst that of the exponents of other sciences is highly developed. Hence it happens that before any actual problem in geography can be

attacked, the man who is to deal with it must be prepared on purpose for the task, and he must have determination enough to stick to an unpopular subject with little encouragement in the present and small prospects for the future. Such men are not very easily found.

If they can be found, the problems they should be set to solve are at hand and waiting. We know enough about the relations of mobile distributions to fixed environments to feel satisfied that the relations are real and of importance; but we do not yet know enough to determine exactly what the relations are and the degree in which they apply to particular cases. It is the province of geography to find this out, and to reduce to a quantitative form the rather vague qualitative suggestions that have been put forward. The problem is multiform and manifold, applying to a vast range of phenomena, and those who have surveyed it are often inclined to sigh for a Kepler or a Newton to arise and call order from the chaos.

A vast amount of material lies before the geographer with which to work, even though, as has been explained, much more is needed before the data can be looked upon as complete. After seeing that the missing facts are in course of being supplied, the great thing is to work and to direct the work of others towards the proper comprehension of the facts and their bearings. This involves as much the checking and discouragement of work in wrong or useless directions as the help and encouragement of well-directed efforts.

The first element of geography is the configuration of the crust of the Earth, and our knowledge is already ripe for a systematic classification of the forms of the crust, and for a definite terminology by which to describe them. For some reason, not easy to discover, geographical terms, with the exception of those handed down from antiquity, have not, as a rule, been taken from the Greek like other scientific terms. They have usually been formulated in the language of the author who has introduced them. For this reason they retain a national colour, and, absurd as it may seem to scientific reflection, national or linguistic feeling is sometimes a bar to their general adoption. A more serious difficulty is that different languages favour different modes of thought, and thus lead to different methods of classification. The clearness and definiteness of French conduces to the use of simple names, and the recognition of definite features distinguished by clear differences. The facility for constructing compound words presented by German lends itself to the recognition of composite types and transition forms, the introduction of which often swells a classification to an almost unmanageable complexity. English stands intermediate between those languages, less precise perhaps than French, certainly less adaptable than German, and English terminologies often reflect this character. The best way out of the difficulty seems to be to endeavour to arrive at a general understanding as to a few broad types of land form which are recognized by

every one as separate and fundamental, and then to settle equivalent terms in each important language by an international committee, the finding of which would have to be ratified by the national geographical societies. These terms need not necessarily be identical, nor even translated literally from one language into another, but their equivalence as descriptive of the same form should be absolute. A recent international committee appointed for the nomenclature of the forms of sub-oceanic relief put forward certain suggestions in this direction which might well be adapted to the forms of sub-aëriel relief as well. But there are strong-willed geographers who will recognize no authority as binding, and who will not, I fear, ever conform to any scheme which might threaten their liberty to call things as they please.

Personally, I would go very far to obtain uniformity and agreement on essential points, but the only way to do so seems to be to arrive by general consent at a classification that is as brief, simple, and essential as possible.

It is necessary to classify land-forms according to their resemblances and differences, so that similar forms may be readily described, wherever they may be. The fixed forms of the crust are the foundation of all geography, the ultimate condition underlying every distribution, the guiding or controlling resistance in every strictly geographical change. The question of place-names is altogether subordinate. It is convenient that every place should have a name, and desirable that the name should be philologically good, but the national boards of geographic names, geographical societies, and survey departments see to that, and do their work well. The question of terminology is far more difficult and, I think, more pressing.

The grand problem of geography I take to be the demonstration and quantitative proof of the control exercised by the forms of the Earth's crust upon the distribution of everything upon the surface or in contact with it which is free to move or to be moved. It is a great problem the full solution of which must be long delayed, but every part of it is abud with minor problems of detail, alike in nature, but differing widely in degree. These minor problems claim our attention first, and are so numerous that one fears to attempt their enumeration because of the risk of distracting attention from the main issue. Geography was defined long ago as the science of distribution; but the old idea was statical distribution, the laying down on maps of where things are; now we see that we ought to go further, and discuss also how the things came there, why they remain there, whether they are in transit, and, if so, how their path is determined. We are learning to look on distribution from its dynamical side, the Earth with all its activities being viewed as a machine at work. The geographer, as an independent investigator, has to deal only with matters touching or affected by the crust of the Earth; his subject is limited to a part only of the economy

of the Kosmos, a fact that sometimes seems to be in danger of being forgotten.

The quantitative relationships of crustal control have to be worked out for different areas with different degrees of detail. A great deal has been done already, and the material for much more has been collected in a form fit for use. The first step in commencing such a discussion is the accurate mapping of all available data—each kind by itself—for the particular area. On the national and almost continental scale, this is done better in the United States Census Reports than in any other works known to me. An adequate discussion of all that is shown in the maps accompanying these Reports, and in those of the Coast and Geodetic Survey, the Geological Surveys, and the Department of Agriculture, would be almost an ideal geographical description. The material provided in such rich profusion by the Federal and State governments is being used in American universities with an originality and thoroughness that has developed the conception of geography and advanced its scientific position. American geographers more than others have grasped the dynamic idea of geography, and realized that the central problem is the elucidation of the control or guidance exercised by fixed forms on mobile distributions.

Detailed work in the same direction has been done by many European geographers whose works are too well known to require citation; but the geographical treatment of statistics has not been taken up adequately by public departments in the countries east of the Atlantic. I will touch only on the instance most familiar to me. Except the publications of the Admiralty, Ordnance and Geological Surveys, which cannot be surpassed, the maps issued by British Government Departments in illustration of their reports are rarely more than diagrams delimiting the areas dealt with, but not depicting the distributions. This is the more regrettable because the accuracy and completeness of the statistics in the reports are inferior to none, and superior to most work of a similar character in other countries. As frequently happens, private enterprise has stepped in where official action is wanting, and it is a pleasure to the geographer to turn to the recent maps of Mr. J. G. Bartholomew, especially the volume of his great Physical Atlas, the Atlas of Scotland published some years ago, and the Atlas of England and Wales which has just left the press. Both of the latter works contain general maps based on statistics that have not been subjected to cartographic treatment before, and attention may be drawn in particular to the singularly effective and suggestive mapping of density of population. Another work similar in scope and no less creditable to its compilers is the Atlas of Finland, prepared by the active and enlightened Geographical Society of Helsingfors. In Germany, France, and Russia also examples may be found of good work of this kind, sufficient to whet the desire for the complete and systematic treatment of each country on the same lines.

It seems to me that the most useful application of youthful enthusiasm in geography, such as breaks forth in the doctorial theses of German universities, and is solicited in the programme of the Research Department of the Royal Geographical Society, would be towards the detailed comparison of the distribution of the various conditions dealt with statistically in Government Reports with the topographical map of selected areas. The work would, of course, not stop with the maps, for these, when completed, should be tested and revised as fully as possible on the ground, since geography, be the scale large or small, is not advanced by maps alone.

Such small portions of the co-ordination of existing surveys are, at the best, no more than fragments of a complete scheme, but they show what can be done with existing surveys and actual statistics, and indicate where these may be appropriately reinforced by new work. I have treated a special case of this kind pretty fully in papers to which it is only necessary to refer.* One section of the scheme outlined and exemplified in these papers is the distribution of rainfall viewed in relation to the configuration of the land, and with the active assistance of nearly four thousand observers in the British Isles, I feel that there is some prospect, though it may lie far in the future, of ultimate results from that study.

The system of botanical surveys now being carried on with signal success in many countries is in some ways even more interesting. It includes the mapping of plant associations and the discussion of their relation to altitude, configuration, soil, and climate. Such phenomena are comparatively simple, and the influence of the various modifications of geographical control is capable of being discovered. I need only mention the similar problems in animal distribution, both on land and in the sea, to the elucidation of which many able workers are devoting themselves.

Difficulties increase when the more complicated conditions of human activity are taken into account. The study of the geographical causes determining, or assisting to determine, the sites of towns, the lines of roads and railways, the boundaries of countries, the seats of industries and the course of trade, is full of fascination and promise. It has yielded interesting results in many hands; above all, in the hands of the leading exponent of anthropogeography, the late Prof. Ratzel, of Leipzig, whose sudden death last month is a grievous loss to geographical science. Had he lived he might have carried the lines of thought, which he developed so far, to their logical conclusion in the formulation of general laws of universal application; but that task devolves on his disciples.

Separate efforts in small and isolated areas are valuable, but a

* *Geographical Journal*, 7 (1896), 345–364; 15 (1900), 205–226, 353–377.

much wider basis is necessary before general principles that are more than hypotheses can be deduced. For this purpose there must be organized co-operation, international if possible, but, in the present condition of things, more probably on a national footing for each country. To be effective, the work would have to be on a larger scale and to be continued for a longer time, than is likely to appeal to an individual or a voluntary association. One experienced geographer could direct an army of workers, whose task would be to collect materials on a properly thought-out plan, and from these materials the director of the work could before long begin to produce results, probably not sensational, but accurate and definite, which is far better. The director of such a piece of work must be free to disregard the views of the collectors of the facts with which he deals, if, as may very well happen, these views are at variance with scientific principles.

A complete geographical description should commence with a full account of the configuration of the selected area, and in this I lay less stress than some geographers feel it necessary to do upon the history of the origin of surface features. The features themselves control mobile distributions by their form irrespective of the way in which that form was produced, and although considerations of origin are often useful and always interesting, they are apt to become purely geological. The second point to discuss is the nature of the actual surface, noting the distribution of such geological formations as volcanic rocks, clays, limestones, sandstones, and economic minerals, the consistency and composition of the rocks being the points to which attention is directed, the geological order or age an entirely subordinate matter. To this must be added a description of the climate as due to latitude, and modified by altitude, exposure, and configuration. Then the distribution of wild and cultivated plants in relation to their physical environment, and of the industries depending on them and on other natural resources. As the conditions increase in complexity, historical considerations may have to be called in to aid those of the actual facts of to-day. The lines of roads and railways, for example, are usually in agreement with the configuration of the localities they serve; but anomalies sometimes occur the explanation of which can only be found by referring to the past. The more transitory features of a country may have acted differently at different times in affording facilities or interposing barriers to communication. The existence of forests long since destroyed, of marshes long since drained, of mineral deposits long since worked out, or of famous shrines long since discredited and forgotten, account for many apparent exceptions to the rules of geographical control. In long-settled countries the mobile distributions do not always respond immediately to a change of environment. A town may cease to grow when the causes that called it into existence cease to operate, but it may remain as a monument

to former importance and not wither away. As one ascends in the geographical system, the mobility of the distributions which have to be dealt with increases, the control of crust-forms upon them diminishes and non-geographical influences come more and more into play. It may even be that causes altogether outside of geographical control account for the persistence of worn-out towns, the choice of sites for new settlements, or the fate of existing industries. If this be really so, I think it happens rarely, and is temporary. Geographical domination, supreme in simple conditions of life, may be modified into geographical suggestion; but in all stable groupings or continuous movements of mankind the control of the land on the people will surely assert itself. How? and To what degree? are the questions to which the modern geographer must seek an answer.

A special danger always menaces the few exponents of modes of study which are not yet accepted as of equal worth with those of the long-recognized sciences. It is the Nemesis of the temptation to adopt a plausible and probably true hypothesis as the demonstrated truth, and to proclaim broad and attractive generalizations on the strength of individual cases. Geographers have perhaps fallen into the error of claiming more than they can absolutely prove in the effort to assert their proper position; but the fault lies mainly at other doors. In geography it is not always easy to obtain exact demonstrations or to apply the test of accordance with fact to an attractive hypothesis; and it is necessary to be on guard against treating such speculations as if they were truths. The methods of journalism, even of the best journalism, are to be absolutely discouraged in science. The new is not necessarily truer or better than the old simply because it is new, and we must remember that time alone tests theories. It is a danger to become too popular. The scientific study of geography should be carried on with as many safeguards of routine verification and patient repetition, and it may be within as high a fence of technical terminology, as, say, physiology, if the proper results are to be obtained. Unfortunately, the idea is prevalent that geography is an easy subject, capable of being expounded and exhausted in a few popular lectures. I regret to see the growing tendency amongst teachers of geography to deprecate the acquisition of facts, to shorten and "simplify" all chains of reasoning, to generalize over the heads of clamant exceptions, and even to use figures, not as the ultimate expression of exact knowledge, but merely as illustrations of relative magnitude. I quite allow that all this may be legitimate and laudable in the early stages of elementary education, but it should never pass beyond, and every vestige of such a system of evading difficulties should be purged from the mind of the aspirant to research.

The facts available for the advancement of geographical science are neither so well known nor so easily accessible as they should be.

Much has been done towards the indexing of the current literature of all sciences, and geography is peculiarly fortunate in possessing the exhaustive annual volumes of the *Bibliotheca Geographica*, published by the Berlin Geographical Society, the carefully selected annual bibliography of the *Annales de Géographie*, the critical and systematic chronicles of the *Geographische Jahrbuch*, and the punctual monthly lists and reviews of the *Geographical Journal* and *Petermanns Mitteilungen*, not to speak of the work of the 'International Catalogue of Scientific Literature.' A great desideratum is an increase in the number of critical bibliographies of special subjects and particular regions, prepared so carefully as to relieve the student from the necessity of looking up any paper without being sure that it is the one he requires to consult, and to save him from the weary labour of groping through many volumes for fragmentary clues. In addition to the sources of information usually catalogued in one or other of the publications cited, there exist in every country numbers of Government reports and quantities of periodical statistics too valuable to deserve their usual fate of being compiled, printed, stored away, and forgotten. There is scope for a great deal of hard but very useful and permanently valuable work, in throwing all these open to working geographers by providing analytical indexes. This would make it easier to discuss current Government statistics with the highest degree of precision, and to compare past with present distributions. All such statistics should be subject to a cartographical treatment no less rigidly accurate than the ordinary arithmetical processes.

The ultimate problem of geography may perhaps be taken as the determination of the influence of the surface forms of the Earth on the mental processes of its inhabitants. But a host of minor problems must be solved in cutting the steps by which that culmination may be reached. Let us first find, if possible, what is the true relation between the elevation, slope, and exposure of land and climate; then the exact influence of elevation, slope, soil, exposure, and climate on vegetation; then the relation between all these and agriculture, mining, manufactures, trade, transport, the sites of towns, the political associations of peoples, and the prosperity of nations. After that we may consider whether it is possible to reduce to a formula, or even to a proposition, the relation between the poetry or the religion of a people and their physical surroundings. The chemist Chenevix wrote a book in two volumes a hundred years ago to demonstrate the inferiority of a particular nation, against one of whom he bore a personal grudge, and he was bold enough to attempt to justify the formula $C = f\lambda$, where C represented civilization, λ the latitude, and f a function so delicately adjusted as to make the value of C negative on one side of a channel 20 miles wide and positive on the other! We cannot hope to arrive by any scientific process at so definite a formula, but the only way of getting there at all is by forging the links in a chain of cause and effect as

unbroken as that which led from the "house that Jack built" to the "priest all shaven and shorn."

The last of the problems of geography on which I intend to touch is that of the training of geographers. So far as elementary instruction in geography is concerned I have nothing to say, except that it was bad, it is better, and it seems likely that it will be very good. But between geography as part of the education of a child and geography as the whole life-work of a man there is a gulf as wide as between nursery rhymes and the plays of Shakespeare. The training of an elementary teacher in geography should be more thorough and more advanced than that of a child, but it need not be of a different order. The teacher, whose special function is teaching, must, like the child, accept the facts of geography from the authorities who are responsible for them. Although the two gifts are sometimes happily combined, an excellent teacher may make but a poor investigator.

A would-be geographer has at present adequate scope for training in very few universities outside Germany and Austria. Great advances have been made in the United States, but it is only here and there amongst the universities that steps have been taken to secure men of the first rank as professors, who are not only channels of instruction, but masters of research as well. In the United Kingdom there are lecturers on geography at several universities and many colleges; and although they have done good work, the system adopted fails, in my opinion, on a practical point—the lecturers are so inadequately paid that they cannot afford to give their whole time or their undivided attention to the subject with which they are charged. In such conditions progress cannot be rapid, and research is almost impossible. The absence of any well-paid posts, by attaining which a geographer would be placed in a position equivalent to that of a successful chemist or mathematician or botanist, kills ambition. The man with his income to make cannot afford to give himself wholly to such a study, however great his predilection for it. The man with as much money as he needs rarely chooses "to scorn delights and live laborious days;" and—with some bright exceptions—he has a tendency, when he turns to science at all, to study it rather for his own satisfaction than for the advance of the subject or the help of his fellows. We want some adequate inducement for solid scientific workers, well trained in general culture, and fitted to come to the front in any path they may select; to devote their whole attention—and the whole attention of such men is a tremendous engine—to the problems of geography. The labourer is worthy of his hire, and the services of the most capable men cannot reasonably be expected if remuneration equivalent to that offered to men of equal competence in other subjects is not available. At a few American and several German universities such men can receive instruction from professors who are masters of the science, free to undertake research themselves,

and to initiate their students into the methods of research—the best training of all. If the time should come when there are, perhaps, a dozen highly paid professorships in English-speaking countries, several dozen aspirants will be found, including, we may hope, a few more gifted than their masters, all qualifying for the positions, stimulated by rivalry, and full of the promise of progress. This is not an end, but the means to an end. Rapid progress is impossible without the stimulus of the intercourse of keenly interested and equally instructed minds. Geography, like other sciences, has to fight its way through battles of controversy, and smooth its path by wise compromises and judicious concessions, before its essential theory can be established and universally accepted. We already see, though somewhat dimly, the great principles on which it depends, and they are becoming clearer year by year. As they are being recognized they may be applied in a provisional way to current problems of practical life. The world is not yet so fully dominated by the highest civilization, nor so completely settled, as to deprive geographers of an opportunity of showing how the settlement and development of new lands can best be carried out in the light of the permanent relationships between land and people discovered by the study of the state of matters of long-settled areas at the present day and in the past.*

The practical politician, unfortunately, thinks little of geographical principles, and hitherto he has usually neglected them utterly. Many burning questions that have disturbed the good relations and retarded the progress of nations, even when they did not burst into the conflagration of war, would never have got alight had the consequences of some apparently trifling neglect, or some careless action, been understood beforehand as clearly by the man of affairs as by the student of geographical principles. Perhaps, when geography has obtained the status in the world of learning to which its ideals and achievements entitle it, the geographer may more frequently be invited, when the occasion demands, to assist by his advice in saving his country from extravagance or disaster.

GEOGRAPHY AND EDUCATION.

The Council of the Society have recently been making renewed efforts to secure the better teaching and fuller recognition of geography in our educational system. By issuing suggestions for syllabuses in primary and secondary schools, by renewing their grants to Oxford and Cambridge, and by approaching the various authorities who control

* For a development of this suggestion, see the author's 'New Lands' (London: Charles Griffin. 1901).

examinations, they have endeavoured to call attention to the needs of the times, and as far as they can to meet them.

In November the *Times* published an incisive article by its military correspondent on geography and war, supported by a vigorous leading article, which led to a discussion that can hardly fail to produce good results.

The *Times* correspondent began his article by pointing out that in his opinion the lessons of the South African war had not yet been learned by the Intelligence Department of the War Office. It had taken no steps to prepare and distribute a map of the theatre of war in the Far East which could be read by our officers, most of whom could not be expected to decipher the names on the Russian and Japanese staff maps, even if they were able to obtain them. This should have been done, not merely to enable our military men to follow the history and learn the lessons of this great war more intelligently, but to familiarize them with a country in which, considering our close alliance with one of the belligerents, it was not impossible that they might be called upon to fight themselves. Even the maps issued by our public departments were a disgrace (a criticism which is not true of the publications of the Ordnance Survey, though it is not too strong a term for certain official maps). He gave a number of striking examples of the costly and occasionally tragic consequences of inaccurate maps, *e.g.* in marches through little-known countries, or in laying the Abu Hammad railway, and hinted that the ignorance of ministers had contributed to the misleading of armies. Even important official maps were not always known to the authorities, and the Colonial Office was said to have supplied a German map to an officer under orders for Nigeria, in ignorance of the existence of the War Office map!

"How could knowledge or interest in such matters be expected as long as they are considered of no account in our educational system? It is not possible to deal rationally with military history or strategy, past or present, without knowledge of geography and of theatres of war, and without maps. Yet the systematic study of these branches of learning has been rigorously excluded from the programmes of our military colleges and universities, and remains excluded to the present hour."

The practical lesson of this, he insisted, was that the teaching of geography must be put on a new basis.

"We have suffered, and we shall continue to suffer, in the conduct of military operations, because the teaching of geography has not assumed its proper place in national education, and because the learning of it is not widespread. The interest of the army in this matter is solid with politics, commerce, and finance."

In civil education the same indifference is shown, and "even in the very subsidiary *rôle* of handmaid of history, geography, in some exalted quarters, finds no place." He cited the mapless Cambridge history as an example of this, and he might have noted that though the Victoria

histories of English counties, in their anxiety to omit nothing, include chapters on geology and even on butterflies, yet have no systematic account of the geographical conditions which have exercised a permanent controlling influence on the local history.

"On all sides the neglect of geography leaves a trail of harm. It gives us constant friction in our international relations, and not infrequent wars; it leads our business houses into costly mistakes, and into sins of omission and commission; it does as much as anything else to permit immoral financiers to drain the capital of England by nefarious schemes; it leads to reckless writing in the press, and to the isolation of England in a hostile world."

What, then, is being done by the educational authorities to remedy this undesirable state of things? Unfortunately, he thinks, very little.

"Nothing is more extraordinary than the thesis of the War Office and the Civil Service examiners that for soldiers, administrators, missionaries, and merchants, who have to conquer, develop, reclaim, or exploit a real world, scientific study of that world is superfluous. Can we not all see that in such a theatre as Manchuria, for example—and all theatres of war are alike in this respect—an intelligent classification of ground forms, knowledge of the climate and its influence on the surface of the ground, and on the economic conditions of the campaign, are of the utmost importance? These and hundreds of other points of practical utility are taught by geography; but our system, on the whole, is either not to teach it at all, which has the merit of simplicity, or to pass it round to geologists, economists, historians, or perhaps even to topographers, and to consider we have done something of which we may worthily be proud."

He then gave a review of geographical teaching in our universities, which hardly did justice to the existing conditions as revised in the last year. The present facilities are outlined in an article in the *Geographical Teacher* for October, 1904, and need not be given here. For recent progress we are all thankful, and nothing is more cheering than the growing recognition of the value of the study of geography as an integral part of the historical and economic courses at our universities, although it is still inadequate. Geography is considered too often from a purely topographical or product-distribution point of view, and is introduced for the information it supplies rather than as a discipline which is essential for every student of history or economics who wishes to interpret as well as to record. All university teaching is hampered, moreover, by the student's want of preliminary training, by inadequate endowment, and by the lack of sufficient recognition of the subject towards a university degree.

How is this to be remedied? The correspondence revealed differences of opinion. The *Times* correspondent considered that geography was indispensable to any intelligent man living and acting in the twentieth century, and seemed to think it natural that schools and universities should co-operate in a joint plan of action.

Representatives of the older universities were the first to take up the points raised by the *Times* correspondent, very largely in the form

of a protest that the writer had not done justice to the encouragement which was actually being given by the universities to the subject, a criticism to which, as we have already pointed out, he had unfortunately laid himself open. Except in the case of Mr. Mackinder's letter, this criticism on a single point appears to have been regarded as an adequate answer to all the other points on which the position of the *Times* correspondent was unassailable. Mr. Mackinder, however, while laying equal emphasis on the fact that progress is slowly being made in the universities, was evidently anxious not to put the demand for increased facilities in a form which could not, in the present state of our educational machinery, be introduced except after considerable delay. He insisted very strongly on the importance of the War Office requiring geography as an essential part in the school and subsequent training of officers, as this would correct an existing defect in our military educational system and create a demand for teachers of geography to which the universities must necessarily respond. His attitude throughout was that of the practical administrator who desires to ask for nothing which there is not a reasonable prospect of obtaining, and who fears that by asking too much he may get too little.

The representatives of the Geographical Societies naturally took a more comprehensive view. Our President, in an admirable letter, traced the history of the efforts which have been made by the Society to promote the teaching of geography, including large subsidies to the universities. In the course of his letter he said, "It is no secret that the Council of this Society has been in communication during the last few months with the leading Government Departments, with a view to inducing them to accord geography the place which it admittedly ought to have in their examinations. While certain of the Departments recognize the subject, none of them accord it the independent and substantial position which it ought to hold. The Civil Service Commissioners excused themselves on the ground that the moment was inconvenient for change, and that the subject was not fully recognized in University degrees and in public schools. They underestimate, I think, the present position of geography at the older Universities; but apart from this, may I express a doubt as to their attitude being a reasonable one? Surely the Government departments can easily convince themselves of the value of geography, if they are not already convinced; and, if they come to a favourable conclusion, is it not to their interest and their duty to insist that it be accorded an independent place, carrying substantial marks in their various examinations? If this were done schools and Universities would lose no time in responding to the new conditions."

Dr. Keltie, interviewed by a *Morning Post* correspondent, also gave an account of the work done by the Society since his well-known report in 1884. He showed that, while geography was much more widely

recognized now than twenty years ago, there were still many difficulties to overcome. In addition to the School of Geography at Oxford, a Board of Geographical Studies now existed at Cambridge, and this Board was at present engaged in drawing up a scheme for a special university examination in geography. Another great advance was in the making of military geography a compulsory subject in the entrance examination of the Staff College, ranking equally with military history and with strategy. But, on the whole, the replies of various Government Departments to the recent representations of the Council of the Royal Geographical Society were not very encouraging. While this country ought to be the pioneer in geographical science and teaching, it was still behind foreign rivals, especially the Germans, who constantly scored points because they were so much better educated geographically. In one matter, however, we were the leaders, for the Royal Geographical Society's diploma in surveying was being taken by more students, both military and civil, every year, and last year Mr. Reeves had almost fifty students, including a number of foreigners, some of them Germans, who could not get such a practical training in their own country.

Sir Clements Markham's letter drew a reply from one of the Civil Service Commissioners, who maintained that geography was an examination subject for all candidates except those for the higher appointments, and that in the present state of university recognition of the subject it was useless to demand geography from such candidates.

Mr. Freshfield retorted that the first duty of the Civil Service Commissioners was not to acquiesce in the present public school and university conditions, but to satisfy themselves that every candidate for employment in the public service possessed, as was explicitly stated in their instructions, "the requisite knowledge and ability to enter upon the discharge of his official duties."

Mr. Mackinder, in a second letter, reaffirmed that the military recognition of geography would speedily result in the other authorities falling into line.

Dr. Herbertson pointed out that even if the contention of the Civil Service Commission had hitherto been valid, it could scarcely be maintained much longer. He suggested that successful candidates for Indian, Colonial, and Foreign Office appointments should be required to take a course of geographical instruction before entering on their duties, and pointed out that this could be done without disturbing existing interests.

The subject thus opportunely brought to the notice of the public by the *Times* is not to be allowed to remain a mere expression of pious opinion. The Council of the Society has decided that another letter should be drafted by the Education Committee, and addressed to the various Government Departments, urging that the importance of geography in the public services is such that all candidates for entry into

these services should be required to qualify in geography as a separate subject, and that it ought to be recognized in all public examinations that geography is an independent subject, in which a separate paper of examination should be set, carrying such a proportion of marks as to make geography a first-class subject. They also point out that it is a mistake for the Civil Service Commissioners to wait until the subject is more fully recognized in universities and public schools; that if the various Government Departments are convinced of the value of the subject, they ought to insist on its being accorded a substantial place in their examinations, and as a consequence the effective teaching of the subject would become universal.

The Council has further decided to devote the evening meeting of January 23 to a conference on the subject, to be opened by the President, and to take steps to secure the attendance of those specially interested.

It is obviously impossible at the present moment to see what will be the outcome of these endeavours. In the case of military education, however, there need be no delay, as it cannot, with any show of plausibility, be argued that the soldier can dispense with geography. Decisive action by the War Office, as Mr. Mackinder has shown, is the key to the position, and reform once granted in this direction, it cannot be long before it is accorded in the various departments of civil life.

Perhaps the most significant and important point really is that such a correspondence should have been initiated and carried on, not in one of the technical journals, but in the columns of the *Times*. The geographer, however high his reputation, must always, in urging the claims of this subject, be open to the insinuation that he has a personal end to gain. When, however, public attention is called to the subject by an official article in the columns of a newspaper like the *Times*, it is clear that no purpose beyond the consideration of our imperial needs can possibly be the inspiring motive; and there would seem to be reason to hope that the long and thankless campaign of the geographical societies to arouse enthusiasm in the subject in the educational world, as well as in the public generally, may at last be within reach of success.

THE MOUNTAINS OF TURKESTAN.

By ELLSWORTH HUNTINGTON.

Introduction.

PART I.—PHYSIOGRAPHY.

The Tian Shan Plateau.
- Location and World Relations.
- Climate.
- The Plateau Character of the Tian Shan—Scenery.

IN common usage, the name Turkestan is applied to all of the vast region from the Caspian sea eastward for nearly 2000 miles to the vicinity of Lob Nor, in the very centre of Asia. The people of the region, however, apply the name in a more limited sense to the tract, largely mountainous, lying south of Lake Balkash between longitudes 70° and 80° east of Greenwich. In the eastern part of this more restricted area lies the lofty plateau of western Tian Shan, while just to the south lies the great Alai range on the northern edge of the Pamirs. Among these mountains, in company with the Khirghiz who inhabit them, the writer travelled for three months during the summer of 1903 under the auspices of the Carnegie Institution of Washington. The journey led from Andijan at the end of the railroad in Ferghana across the Tian Shan mountains to Issik Kul, around the northern side of Issik Kul, and again across the Tian Shan to Kashgar, in the desert basin of Chinese Turkestan. From Kashgar the route was west and north over the Terek range which connects the Tian Shan and Alai mountains, and then south across the Alai range to the valley of the same name and back across the mountains to Margelan, the capital of Ferghana.

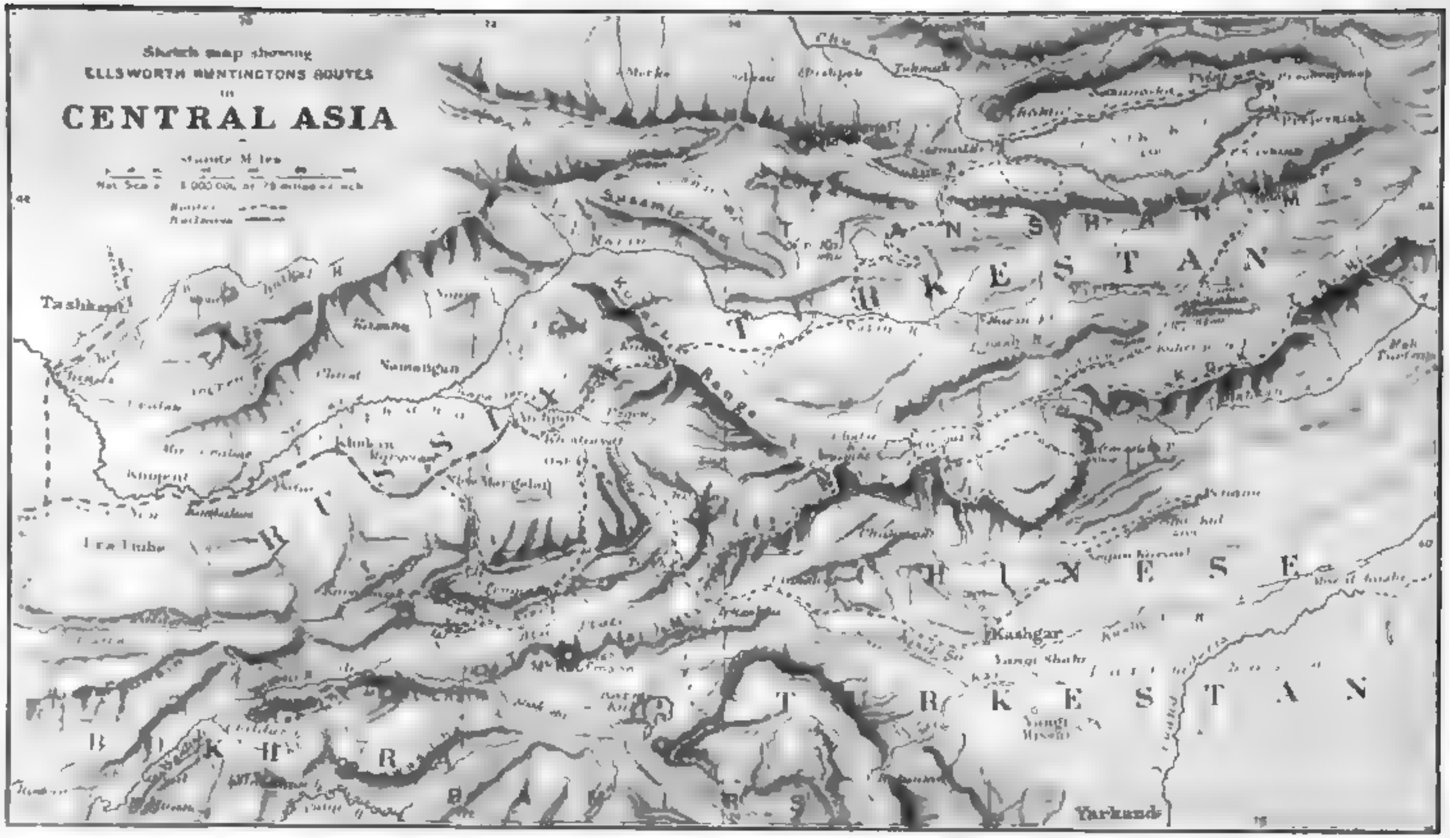
The following paper is an account of the geography of the two closely similar mountain regions of Turkestan, viz. the Tian Shan plateau and the Alai range. I shall present first their *physiography*, a description of

the inanimate features, and then their *ontography*, a description of the animate features. In the second half of the subject, ontography, I shall attempt to point out the causal relation that exists between the facts of physiography and those of life, for it is only in such a study of relations that geography becomes really a science. The present paper is not supposed to be a complete geographical treatment of the regions involved. In the first place, such a treatment is to-day impossible, because the study of the relation between the inanimate facts of physiography and the animate facts of ontography is still in its infancy. We know but a modicum in respect to the influence of environment on habit, and almost nothing of the higher and more fascinating reaches of the subject, the influence of geographic environment on human character. In the second place, this paper is incomplete, because it is based merely on the writer's own observations, without reference to the work of others. Such an incompleteness of treatment may perhaps be excusable in a case where the country in question is so little known, and the writer is still in Central Asia.

The Tian Shan Plateau.

Location and World Relations.—From the Pamirs, the lofty roof of the world, three great mountain masses diverge eastward. The Tian Shan plateau, the northern of these, forms a roughly anvil-shaped mass, with the longer end projecting eastward north of the inhospitable Tarim basin, and the smaller end projecting westward and enclosing between itself and the Pamirs the fertile basin of Ferghana. Between the Tarim and Ferghana basins lies the Terek range, the neck of the anvil, not perpendicular to the head, but bent to the north-east. Few parts of the world are by nature more inaccessible than the Tian Shan plateau, for not only does it lie in the centre of the greatest continental land mass, but its axis lies along the centre of the desert belt caused by the obliquely rotating winds of the northern hemisphere. The distance from the sea is great in every direction, and wherever the contiguous regions are not closely associated with high mountains, they assume the form of broad desert plains.

Climate.—In such a region climatic contrasts must be the rule. The plains are hot and arid, true deserts, which can only be reclaimed by irrigation from the streams fed by the snows of the uplands. In every mountain region the amount of rainfall, up to a certain height at least, increases with the elevation. Where lofty mountains rise out of low desert plains the effect is especially marked, because, though the absolute increase in precipitation may not exceed that in more humid climates, the relative increase is vastly greater; and the effect on vegetation can be very plainly detected. As one ascends the south-west slope of the Tian Shan, the rainfall, as measured by the amount of plant life, increases steadily until at heights of from 9000 to 10,000


Sketch map showing
ELLSWORTH HUNTINGTONS ROUTES
in
CENTRAL ASIA
Tashkent
Namangan
Kashgar
Yarkand
CHINESE
TURKESTAN

feet one enters a region of most luxuriant vegetation. During early July, the time of our visit, rain fell nearly every day on the mountain summits and on the western slopes, and the ground almost steamed under the hot summer sun. Throughout the whole summer, in the region farther east, storms continued to be frequent at high elevations. At heights of over 12,000 feet practically all of the precipitation took the form of snow, and very frequently, even during the hottest season, there were hard frosts at night down to an elevation of 10,000 feet.

Even more marked than the contrast between dry plains and well-watered mountains was the change which our party experienced one day in early July, when passing from the south-western to the north-eastern side of the Kugart range between Andijan and Son Kul. In the morning we traversed a region where rain falls almost daily. The ground was covered with lush verdure, or with the greatest variety of flowers. The cool damp air, the flying clouds, and the frequent showers made it seem like a day in early May. A few hours later, on the other side of the mountains, we were in a barren country where the roads were thick with dust, the grass was meagre and poor, no flowers remained save shrivelled irises, and many hillsides were quite naked. Slopes which are exposed to moisture-laden winds from the west or north are well watered, while those that face in the other direction, or are cut off from the winds by other mountains, are sadly arid.

Between the northern slope of the main Tian Shan plateau toward Issik Kul and the southern slope toward the Kashgar or Tarim basin the contrast is even greater, although not so sudden. The northern slope is green and soft from top to bottom, the valleys are deep glades full of a rich growth of succulent herbs, the sides of the valleys are often dense with rose and barberry bushes, and the main mountain slopes are either covered with smoothly swelling green sod, or are set with a splendid growth of spruces. On the plateau-top the verdure continues in the form of thick grass. The south slope, however, facing the great inner desert, though scantily green with grass and bushes above an elevation of 10,000 feet, is woefully barren in its lower portions. Ragged slopes of naked rock are separated from one another by broad torrent beds of burning gravel. Not infrequently this south slope is impressive simply by reason of its ugliness and dreariness.

Before we leave the subject of climate, one more related effect deserves to be noticed. In the first example given above, that of the contrast between the two sides of the Kugart range, the effect on plant life is due almost wholly to the prevalence of certain winds and the condensation of water-vapour in air that is rising and hence cooling. In the second example, the difference between the vegetation of the two slopes of the main plateau, although due largely to the same cause, is in part attributable to the fact that in the northern hemisphere south slopes receive much more sunshine than do north slopes. Hence they

are drier in summer, a condition unfavourable to vegetation, and in winter are subject to much more frequent freezing and thawing, which tend to cause rapid weathering and erosion, with steepening of the slopes, another set of conditions unfavourable to vegetation. In many parts of the Tian Shan a marked contrast is thus produced between north and south slopes only a few hundred feet apart. Just to the east of the crest of the Kugart range in the locality already mentioned, the northern hillsides slope gently, and are well protected by a green growth of thick sage and less abundant grass, while the southern slopes are much steeper, and show only the red-brown and grey of the naked rocks.

JUKUCHAK VALLEY, ON THE NORTHERN SLOPE OF THE TIAN SHAN PLATEAU, AT THE LOWER LIMIT OF ANCIENT GLACIATION.

The strata are nearly horizontal, and have little or no influence in producing this result.

The Plateau Character of the Tian Shan.—Turning now from external effects, those due to the influence of the sun on the atmosphere of our rotating globe, we come to those that are internal and are due to the Earth's character as a cooling, and hence contracting, solid. In physiographic terms, the Tian Shan plateau may be described as a peneplain which has been highly uplifted and warped, and is now in a state of extreme youth. Long ago the closely folded Palæozoic limestones and slates which form the main mass of the plateau were worn to a peneplain not greatly elevated above sea-level. This was warped into broad shallow basins, and in these were deposited late Mesozoic and

Tertiary strata, mostly soft sandstones and shales. Warping still went on, though very slowly, and on the edges of the basins the new strata were bent upward and were removed from the region of deposition. Then, as the process of erosion and base-levelling still proceeded, the old tilted limestones and shales, and the slightly tilted edges of soft new strata that lay against them, were all once more worn down, so that their surface formed a second peneplain almost at the level of the floors of the basins. In late Tertiary times this last peneplain was slowly uplifted to a great height, until to-day the central portion south of Issik Kul stands at an average elevation of about 12,000 feet. Coincident with the uplifting there was a warping, by which the old basins were again intensified. Since that time erosion has had but little effect in altering the country from the state to which it was brought by the uplifting and warping of the old peneplain.

The result of these geological changes is that, although the *internal structure* of the Tian Shan region is highly mountainous, its *external appearance*, or, in other words, its geographical aspect, is that of a plateau. South of Lake Issik Kul, where the plateau is most characteristically developed, there is a steep rise of 9000 feet from the lake-level to an even-topped ridge about 14,000 feet above the sea. This northern slope is the most beautiful part of the whole plateau. The green and partly wooded slopes that have been already described rise steeply to a cap of perpetual snow, where small glaciers descend one or two thousand feet. Below the glaciers the valleys are fine young gorges with precipitous naked sides rising to a height of several hundred or a thousand feet, and contrasting finely with the smoother slopes of the main mountain-side. Toward the west, where the plateau is less perfectly developed and the topography is more mature, some of the streams are deflected to east-and-west courses, by reason of faults apparently. Toward the east the streams of this northern slope are true consequents, having the form of short steep torrents which flow northward straight down the slope from the edge of the plateau to the lake.

The main mass of the plateau south of Issik Kul reaches a width of nearly 150 miles. It consists of broad shallow basins running east and west in *en echelon* pattern, and lying at an elevation of about 10,000 feet. Between them and bordering them run from five to seven ridges as broad as the basins, and rising by gentle slopes to heights of from 13,000 to 16,000 feet. Striking scenery is rare, for in spite of the great altitude of the mountains, the subdued outlines of the ancient peneplain still dominate the landscape. The treeless basins present monotonous green expanses, some of them, like the Ak Sai basin, 10 or 12 miles wide and 40 or 50 long, while another, that of Chatir Kul, is occupied by a small lake.

The ridges rise by long gentle slopes to flat summits, where often for many miles the sky-line is an almost straight crest from which the

rounded slopes of pure white snowfields descend gradually toward the basins. Here and there the crest-line is notched by high passes, the lowest of which are but 1000 or 2000 feet below the top of the ridge. Oftener the summit of the ridge is broken into individual mountains, broadly flat-topped and of nearly equal height. From between these mountains descend numerous small glaciers, which are so numerous that in the Yak Tash basin, the first to the south of the east end of Issik Kul, I counted twelve in sight at one time, while others that were invisible could be located by the glacial form of their valleys.

A SCENE IN THE AK SAI BASIN EAST OF CHATAR KUL, AT AN ELEVATION OF ABOUT 11,000 FEET. A MEANDERING STREAM HAS INCISED A NARROW VALLEY IN THE OLD PENEPLAIN. COMING FROM THE LOWER RIGHT-HAND CORNER OF THE PICTURE, IT PASSES THROUGH THE STRIKING GATEWAY OF TERTIARY RED SANDSTONE WHERE THE HORSEMEN ARE SEEN, AND JOINS THE MAIN STREAM, WHICH FLOWS FROM RIGHT TO LEFT.

This form is one of the most characteristic features of the Tian Shan plateau. On the side of a ridge in the smooth slope of an otherwise undissected portion of the old peneplain, subparallel, broadly U-shaped grooves begin near the top and deepen gradually downward until they assume the usual steep-sided, flat-bottomed form which is commonly associated with glaciers. The form is such as would be produced if the ridges were made of wax, and grooves were dug in them with an immense sugar-scoop, which was pushed deeper and deeper as it passed from top to bottom.

Before leaving the subject of the ridges one further type deserves

notice. In certain places, notably south-east of Son Kul, snow-covered portions of the old peneplain have been left isolated, and stand as flat-topped or rolling plateau masses 5 or 10 miles in diameter. On almost every side these crinkly edged plateaus are cut off from the surrounding basins by precipitous slopes of naked rock 2000 or 3000 feet high. Either there was faulting along their edges, or the bending was so steep as to give tremendous opportunity for erosion.

Returning now to the main mass of the plateau south of Issik Kul, we find that the streams, which seem for the most part to be consequent, flow but little below the level of the plains, and are characterized by immense gravel flood-plains, sometimes a mile in width. It is when the streams are obliged to break through the ridges in order to pass from one basin to another that the best river scenery is developed. In coming southward from the Kara Sai basin in the centre of the plateau, one rises by gentle slopes over old moraines to Chakir Korum pass, 13,000 feet high. From there it is necessary to descend into the valley that the Kara Kul, a westward-flowing affluent of the Narin Su, has cut in its passage from one basin to the next. Straight below the pass lies a magnificent tributary gorge, reached by a fearful road. For 900 feet our horses stumbled and slipped down a slope of angular limestone fragments, a slope that seemed almost perpendicular, although measurement showed it to be only 35°. At the bottom a flood plain 200 or 300 feet wide lay in the noon shade of lofty walls which in places were actually perpendicular. Lower down the brook flowed unconcernedly under the rubbish of a transverse embankment 200 feet high, the moraine of a little glacier, which from high up on the mountain-side continually poured its angular detritus into the valley, blocking it completely.

Not far below this moraine one enters the main valley of the Kara Kul, a magnificent gorge cut into the solid mountains to a depth of 2000 feet. At the bottom the gorge was once partly filled with gravel, which at a later time was dissected into terraces. On these terraces in certain places lie old moraines, a subject to which we shall shortly return. To the southward the comparatively easy way out of the Kara Kul gorge leads up an open valley to Kubergenti pass, nearly 13,000 feet high, beyond which lies the Mudirum basin, a barren waste of almost naked soil, so high and cold that vegetation has no opportunity to grow during the month or two when the snow is gone. Here and there over its broad surface, and even up to and over Kubergenti pass, lie great granite boulders, left by the glacier that once filled the valley to a width of 5 or 6 miles. Further downstream to the west, where the snow does not lie so late, the basin and the pitted moraines which fill it are green with fine soft grass, and bright with flowers.

Still to the south of the Mudirum basin one sees the range of Kok Tau on the Chinese border, the loftiest and most picturesque of the

Tian Shan ranges. Here the mountains rise to a height of 16,000 feet, and are high enough so that even in the relatively short time since their upheaval they have been carved into forms that are truly alpine. Below the snow-line large glaciers stretch out their moraine-covered tongues from immense U-shaped valleys, while at greater heights the summits of the range have been carved into sharp-edged triangular matterhorns.

In form, at least, the scenery of the southern border of the plateau is more striking than that of the northern portions. Owing to the steeper

A GLACIAL LAKE, ELEVATION OVER 11,000 FEET, IN THE YAK TASH BASIN, JUST SOUTH OF JUKUCHAK PASS. AT BOTH ENDS OF THE LAKE ARE OLD MORAINES. IN THE BACKGROUND RISES ONE OF THE CENTRAL RANGES OF TIAN SHAN.

slope and to the greater extremes of temperature, erosion has been more rapid than elsewhere, and as a result, the valleys are deeper and the peaks sharper. As one crosses Batmanak pass, 40 miles north-west of Shor Kul, and from its 13,000 feet of height looks eastward into China, the view is utterly different from the smooth-featured scenery that has gone before. Huge waves, a score of them, rise higher and higher in the distance, each wave a sharp inaccessible ridge or pointed peak white with new snow on the north side, brown on the other. Further south-west near Shor Kul, the foothills, though buried deep in naked gravel, are still sharp and bristling, and the valleys are barren gorges which assume the most gorgeous red, pink, and yellow colouring where the streams cut through the soft Tertiary deposits of the Tarim basin.

The Alai Region.

The Alai and Terek ranges differ so little from the Tian Shan that but a paragraph will be devoted to them. Each is essentially a great ridge of uplifted peneplain, like the Tian Shan plateau, except that while the latter is a great fold diversified by minor folds forming basins, the Alai and Terek are each a simple arch. On account of its proximity to the loftier Pamirs, and its east-and-west direction, the Alai range presents no marked difference of climate between its two sides, but the Terek range shows the same contrast as the Tian Shan between its well-watered western slope and its dry eastern slope toward the Tarim basin. On the Ferghana side both ranges show the gentle slope of what seems to be the old peneplain bevelling tilted strata belonging both to the old Palæozoic series of metamorphic limestones and to the newer Mesozoic-Tertiary series of softer rocks. Practically all the streams are consequent. In the harder rocks they have cut striking gorges, some of them 1000 feet deep and so narrow that the water flows between walls of solid rock. Where the softer strata prevail, the old peneplain surface is largely destroyed, the valleys widen greatly, and terraces, which have been fragmentary in the narrower portions of the valleys, become well developed. On the eastern side of the Terek range, and on the southern side of the Alai range north of the great Alai basin, the old peneplain is almost wholly destroyed, because of the softness of certain strata and the steep slope given by recent earth-movements.

Glaciation.

In the preceding sections glaciation has been often referred to. As I have discussed this subject at some length in another place, I shall here merely review the main conclusions. Throughout all the high mountains of Turkestan glaciers are numerous at elevations of over 12,000 feet. The great majority are small, not over a mile in length, and come to an end close to the mouths of their cirques, and even the largest seen, that of Kok Su or Khoja Ishkhen in the Alai mountains near the boundary of Bukhara, reached a length of scarcely 5 miles. In ancient times, however, as is amply shown by old moraines and abandoned glacial valleys, glaciation was much more extensive than to-day, and certain glaciers, such as those of Khoja Ishkhen, Yak Tash, Mudirum, and others, reached lengths of 20, 30, and even 50 miles.

In all the larger valleys there is evidence that in ancient times moraines were deposited successively in several different places, each farther up the valley than its predecessor. One of the best examples of this is at the head of the Jukuchak valley, which descends northward for about 20 miles from the northern edge of the Tian Shan plateau to the eastern end of Issik Kul. At an elevation of about 8600 feet, as one

ascends the valley, there is a sudden change from a V-shaped gorge, narrow and steep sided, to a U-shaped valley, open and round bottomed, which is filled with a deposit of large boulders and other glacial material. There seems to be little doubt that this latter is an old moraine, although all traces of morainic topography have disappeared. Above this for a space the valley is open and unencumbered, except for a little gravel that has been laid down by the stream itself. Then comes a second moraine, smaller than the first, and apparently younger, as it shows the moraine topography. Next comes a second open space of a mile or two, which continues till a third still younger moraine

THE MOUNTAINS OF CHINESE TURKESTAN, LOOKING EASTWARD FROM BOTMANAK PASS, ON THE SOUTHERN BORDER OF THE TIAN SHAN PLATEAU. ELEVATION 13,000 FEET.

again blocks the valley. Still farther upstream a fourth and fifth moraine appear in the same way, and finally the present moraine comes in at a height of a little over 11,000 feet. Other instances of the same sort, such as the Khoja Ishkhen and Mudirum moraines might be cited if space allowed. All of them seem to show that during the glacial period, here, as in Europe and America, there were several epochs, probably five, each less intense than its predecessor.

Having come to this conclusion, the question at once arises, Were these glacial epochs separated by warm interglacial epochs, or do the moraines merely mark successive stages in a single intermittent retreat? Moraines like those instanced above indicate nothing as to this point.

The lower ones are clearly decidedly older than the upper, but in either case that would be true. Other moraines, however, seem to indicate that the hypothesis of cold glacial epochs alternating with warm interglacial epochs is the true one. On half of the more than twenty cases that I saw, the younger moraine does not lie upstream from an older one, but at approximately the same level inside the remnants of its predecessor. The only explanation of this seems to be that after the oldest glacier had filled the valley with moraine stuff at a certain point, it withdrew, and the stream from its foot flowed through the moraine and cut in it a trench. Into this in course of time the glacier again advanced, and deposited a younger, smaller moraine inside the first one, which latter remained as a terrace on either hand. The point to which the ice withdrew must have been at least as far upstream as the head of the terrace, and this, in some cases, is close to the moraine that is now forming or even above it. In the case of the Taka valley on the south side of the Alai basin, four such glacial terraces can be seen, indicating five advances of the ice. These facts, and many others which must perforce be omitted, seem to justify us in concluding that in Turkestan the glacial period consisted of five decreasingly severe epochs of ice-advance separated by interglacial epochs of ice-retreat, during which the climate was as warm or warmer than to-day.

Terraces and their Relation to the Glacial Period.—More important than the old moraines are the terraces which form an almost universal feature of the valleys of Turkestan. They are best developed along the middle courses of the streams, but are often found from end to end. Occasionally there is only one terrace, but usually there are more, and where they are best developed the number amounts to five or six. They are found along streams of every size, and along those that flow in every direction, whether it be to lake, river, or desert. On a given stream they are very persistent, disappearing in narrow gorges, but reappearing as soon as the valley widens. Along some streams each terrace is cut partly in gravel and partly in rock, while along others they are cut wholly in gravel which fills the valley bottom. In either case it seems clear that there have been repeated, though diminishing, oscillations between two sets of conditions. Under the first the streams cut straight downward without materially widening their valleys; under the second they stopped cutting downward, and either cut sidewise as in the case of the terraces cut in stone, or else went so far as to fill their valleys in the cases where the terraces are cut in gravel. Phenomena of such remarkable uniformity over an immense area and involving such systematic and delicately balanced oscillations from one set of conditions to another can hardly be explained by any hypothesis of tectonic movements. The only other cause competent to produce such effects seems to be climatic change, and so far as I can see, such an hypothesis seems to fit all the facts. During a time of moist, cool

climate, when rain fell often, when vegetation was abundant and weathering was rapid, the streams would be large and very heavily loaded, but would not be liable to floods. Accordingly they would broaden their beds and deposit gravel. When, on the other hand, the climate was warm and dry, weathering would be slow and vegetation would be scarce. Floods would be the rule, and the streams would tend to cut rapidly downward. If times of increased cold and rainfall, such as the glacial epochs shown by the old moraines, alternated with times of warmth and aridity such as interglacial epochs, and if the intensity of conditions decreased from epoch to epoch, the effect would be to form

BRIDGE OVER THE KOK SU, JUST EAST OF TEREK PASS, ON THE HIGH-ROAD FROM KASHGAR TO FERGHANA.

terraces such as those that we have described. That the terraces and the old moraines were in process of formation at the same time is shown by the relation in which they stand to one another. Along the Kara Kul river in the centre of the Tian Shan plateau, certain moraines of middle age lie on the upper or older terraces, while the younger terraces have been cut in or below the material of the moraines. In view of all the facts regarding moraines and terraces, we are led to the conclusion that both are due to the same cause. That cause seems to be the glacial period, which must have consisted of at least five epochs of increased precipitation, alternating with interglacial epochs when the climate was similar to that of to-day. The effect of these alternations of

climate is the last touch that has brought the uplifted peneplain of Turkestan to the condition in which we see it to-day.

ONTOGRAPHIC RELATIONS.

In the preceding part of this paper attention has been confined almost exclusively to the physiographic side of geography. In the remaining portion I shall try to show the relation of a few of the inanimate facts of physiography to the animate facts of ontography. Even a most cursory examination of the life of any region shows that the lower forms support the higher; animal life is absolutely dependent on plant life. Therefore the conditions which are most effective in determining the distribution and character of plants are indirectly the most effective in determining the distribution and character of animals, and finally of man. Soil, water, and sunshine are the factors on which plants chiefly depend, but the three are of very unequal importance. If conditions of either water or sunshine are unfavourable, plants will not flourish no matter how good the soil may be, while if these conditions are favourable plants will flourish in even the poorest soil. To a certain extent the distribution of water and sunshine depends on surface forms, such as valleys, basins, hills, mountains, and northern or southern exposures, but in the main they are an expression of climate. Thus it comes to pass that climate is by far the most important element in determining the distribution of plants, and hence of animals and men. So universally is this recognized that we appeal continually to the character of vegetation as an evidence of the climate of a region.

Vegetation.—As has already been said, the climate of the high mountains of Turkestan is such that in most places vegetation is abundant and rich. For some reason trees are very rare except in the valley bottoms and in certain areas on the northern slopes of the Tian Shan and Alai. What few exist are largely spruces and cedars, with some poplars and birches. Grass abounds almost everywhere, and often possesses the soft, thick, luxuriant greenness that is characteristic of English scenery. In the Kugart valley, at a height of 3500 feet on the south-west slope of the Tian Shan, grass and weeds had grown to such a height by the end of June that in walking through them one found the view obstructed. Here, as in most places where agriculture is practised among the mountains, wheat was growing with but little irrigation, and could be grown with none at all. Farther up the same Kugart stream, at heights of 6000 feet and over, the valley sides were covered with a smooth growth of short grass, while among the rocks and in the valley-bottom assafœtida and other big-leaved succulent weeds were interspersed with roses, purple columbines, and a few poplar trees. A day's ride farther to the north-east, on the terraced valley sides beyond the pass at the head of the Kugart stream, the flowers were even more

beautiful and varied. The majority closely resemble those that grow at home, except for differences in colour. The large geranium is blue; the roses at this season, the first of July, are generally yellow, though some are white; the poppy is lemon-yellow; the bluebell is of a very delicate pale colour; the spherical heads of the wild onion are crowded with flowers of an intense lilac hue; and the unripe barberries are deep purple. Among the flowers scattered along the roadside none fitted its

THE TEREK VALLEY, JUST WEST OF THE TEREK PASS, ON THE HIGH-ROAD FROM KASHGAR TO FERGHANA.

surroundings better than the usually obtrusive peonies, spots of deep rich red, almost hidden among thick green leaves of many shades. Farther down the same valley the broad grassy plain of a terrace was tinted blue with gentians—not the fringed variety, but the sweet-scented kind that opens in spring with us.

Dozens of other flowers make the gentle slopes of the grassy mountains wonderfully attractive. Around Son Kul during the second week in July, just after the melting of a foot of fresh snow, the newly

sprouting grass at a height of 10,000 feet was exuberant with spring flowers—buttercups, violets, innocence, edelweiss, splendid irises, purple phlox, large orange cowslips, delicate sweet-scented daisies with lavender petals and yellow centres, and many others whose names I do not know. A week later, on the northern slope of the Tian Shan plateau south of the western end of Issik Kul, rhubarb and alpine candytuft were the rule. The effect of differences of soil in altering the character of vegetation was here well brought out on an old moraine half buried in a green flood-plain. From a distance the outline of the moraine was clearly distinguishable by reason of its bluish-grey colour; nearer at hand the moraine looked even bluer. It proved to be completely covered with forget-me-nots, while not a single flower of this kind grew in the green plain. Farther east on this same northern slope of the plateau, at a height of from 10,000 to 11,000 feet, many old moraines were studded not only with yellow poppies, but with pansies and with the small flowers of the same genus whose old-fashioned name is "ladies' delight." There were purple and yellow varieties of both species, and in both there was a good deal of variation, just as there is among cultivated varieties. So numerous were the pansies, that on one old moraine I sat down to see how many I could pick without moving from my seat. I gathered seventy-four, mostly purple.

Although flowers are exceedingly abundant on the slopes of the mountains, they are relatively rare on the main upland of the Tian Shan itself. There the vegetation is chiefly grass, with a scattering of small Alpine flowerets. Among the plants of this high altitude the most unusual is a short bunchy thistle looking like a cylindrical cactus, 1 foot high and 5 inches thick. Our dog looked very sheepish as he turned back from a headlong run, on discovering that the first one which we encountered was not a marmot sitting before its hole.

In this consideration of the vegetation of the mountains of Turkestan, I have said little of the plants that are of use in agriculture, for the simple reason that this art is scarcely practised, except in a few of the lower valleys. Fruits, too, and berries are rare. At an elevation of from 6000 to 7000 feet in the Kichik Alai valley south of Osh, I found in one place a number of wild fruits, such as apricots, slightly astringent, but still agreeable; plums, a little red variety no bigger than a cherry, and growing on scraggy bushes 5 or 6 feet high; "chichirkanak," a fine-leaved olive, with very small and acid golden fruit that cannot be eaten; and "dolona," a pretty tree closely related to the apple, and bearing racemes of a pulpy golden yellow or reddish fruit the size of a small cherry.

On the whole, the most interesting features of the vegetation of these mountains in the heart of Asia are—first, the sudden contrasts which were described in the section on climate; second, the absence of trees, due in part perhaps to the high elevation; third, the great

amount of grass; fourth, the great variety and beauty of the flowers; and, lastly, the great number of plants that are known to the civilized world as garden products, but here grow wild. At the risk of repetition, I will give a list of the plants, which I happened to record, that grow wild in the Tian Shan and Alai mountains, but are cultivated in Europe and America. These comprise the apple, apricot, asparagus, candytuft, and chrysanthemum; the large blue and purple varieties of columbine; the crocus, heliotrope, olive, and onion; the pansy and ladies' delight, both purple and yellow; the peony, phlox, plum, and poppy, red and yellow; the rhubarb; the rose in red, yellow, and white varieties; and the tulip. That there are many more than these nineteen species I am well aware, but they are enough to show the general character.

Animal Life.—Animal life, aside from that which is dependent on man, is not abundant among the mountains of Turkestan. The plants of the temperate zone have adapted themselves to a climate that alternates between cold winters and warm summers, and have acquired the habit of suspending their life functions during the period of cold. Animals, however, especially those of the higher kinds, have learned this lesson but imperfectly. Insects overcome the difficulty in much the same way as plants, either, like annuals, dying in the fall and leaving their eggs to reproduce their kind, or, like perennials, becoming torpid in winter and recovering in the spring. Thanks to this habit, insects abound wherever plants abound to furnish them with food. At the eastern end of Issik Kul, where flowers are very abundant, man makes use of this fact to his own advantage, and great numbers of bees are kept. Reptiles, like some insects, have adopted the perennial habit, but notwithstanding this they are very rare in the high mountains of Central Turkestan. My notes contain no record of either turtles or snakes, and, so far as I can remember, the only reptiles were a few lizards at low altitudes.

Birds have adopted quite a different method of meeting the exigencies of seasonal changes of climate. Being able to migrate at will, they can come to a given region whenever conditions are favourable. Accordingly, in summer the lower slopes of the mountains are inhabited by birds of many kinds. At the end of June we found the Kugart valley full of meadow larks, and at a height of 5000 or 6000 feet the bushes and grass were alive with chattering flocks of rose starlings. In the very lofty regions of the main plateau, birds, as well as insects, are not particularly abundant, but such places as the shores of Issik Kul swarm with them.

Of all animals, mammals are least able to adapt themselves to severe seasonal changes and long winters. In the high mountains of Turkestan, a few, such as the mouflon, antelope, and argalleh, eke out a precarious existence by digging under the snow in winter. Others,

such as rabbits, live underground, and obtain a meagre winter sustenance by gnawing bark and buds. When herbivorous animals are so scarce, beasts of prey cannot be numerous. Only one, the wolf, is at all important, and he is so rare that during three months' travel I encountered but one. Aside from these animals, there is one mammal, the marmot, that is thoroughly adapted to his surroundings. He has acquired the habit of the perennial plants, and sleeps comfortably deep underground during cold weather, only coming out for a few months during the summer, when he quickly grows fat on the rich grass that surrounds his hole. Most of the marmots live at an elevation of from 9000 to 12,000 feet, where the grass is richest. Old moraines, being soft and easy to dig into, are a favourite resort. So numerous are these little animals, that one day in mid-July, as I rode slowly along on the Chinese border near Chatir Kul, I counted twenty-eight in twenty minutes. A month later in the Alai valley I counted thirty-five during half an hour. The abundance of this one animal, which is thoroughly adapted to its surroundings, shows how great might be the amount of animal life if the ground were not so long covered with snow.

(To be continued.)

THE PHYSICAL HISTORY OF THE VICTORIA FALLS.

By A. J. C. MOLYNEUX, F.G.S., F.R.G.S.

The majesty of the Victoria falls is daily inspiring attempts at descriptive writing, and already, by the aid of the illustrated journals, photographs of some of the natural beauties of the chasm and cataracts are familiar. But of the causes and processes that have led to this wonder of a wondrous continent few, if any, writers have given an idea, and the theory of Dr. Livingstone—the discoverer of the falls—remains uncontroverted, nay, is repeated by each succeeding traveller who has described them, and is accepted by each visitor of to-day. Yet the general desire is for some more detailed explanation of the processes that have been used by nature in soulpturing these beetling precipices and deep chasms. In seeking such explanation many points must be considered. The imagination must recall pictures of the geography of Africa when great lakes filled the depressions of the plateau now occupied by the Chobe, Botletle, Ngami, and upper Zambezi, and reference must be made to the present-day conditions of the Zambezi river system.

The Zambezi River.—Running close to and parallel with the south and east coast of Africa is a mountain chain that, except in the cases of the Zambezi and Limpopo rivers, forms the watershed of the streams that flow to the Indian and Atlantic oceans. Eastward

of this elevated axis the coastal lands are narrow, and the rivers reach the sea by courses of from 200 to 300 miles, while, on the contrary, rivers draining the western slopes have to pursue long meanderings nearly across the whole continent before discharging into the Atlantic, such as the Orange and the Congo.

Geographers are of the opinion that, in earlier times, the waters now flowing into the Limpopo and Zambezi were collected in large lakes on the elevated central plateau lying between the Kalahari desert and the Barotse country, and thence made their way to the western ocean. Into this central "saucer" the rivers from the German territory to the north-west, the Zambezi to the north, and the Nata river from the Matabeleland plateau discharged themselves. Now, however, the mountainous backbone that runs along the east coast of South Africa is cut through, and the Zambezi and Limpopo rivers deliver their burdens to form the swampy and deltaic lands of the Portuguese east coast, while the central lakes are nearly dried up. Where this mountain backbone crosses Rhodesia it is formed of granites, gneiss, and schists, and impinging against it are the sedimentary rocks of the South African coal age. The Limpopo has eroded its course through this complex to a lower level than its northern compeer, and though held back at one time by similar geological features (the Tuli lava-sheets), it now passes its water rapidly out to the ocean, and its lower central parts take, in winter, the form of a sand river.

The Zambezi is still battling against the obstacles that seek to check its erosive action, and which divide it into three long reaches. The one impediment is that which causes the mighty cascade of the Victoria falls, 1000 miles from the coast, and the other is the series of rapids known as the Kebrabasa, 360 miles up. It is at the latter that the river passes by the gorge that it has gnawed in the elevated watershed, here reaching an altitude of 4000 feet, to the coastal plains beyond.

The deltaic regions of the river are naturally tame and uninteresting (2, p. 27),* with low and marshy banks 3 to 4 miles apart and many intervening islands; but at a distance of 260 miles from the coast the monotony ceases, and a range of hills crossing the river in a north-easterly direction has necessitated the natural erosion of the deep and narrow channel known as the Lupata gorge. Above this are the foothills of the mountain axis, the country becomes more hilly and picturesque, and more populated, while the currents of the river are stronger, until 100 miles further up we are confronted by the mountains in which lies the Kebrabasa gorge, forming the east flank of the South Central African plateau, 3000 to 4000 feet in altitude.

According to Livingstone's description (2, p. 36), the lofty range

* See references to literature at the end of the article.

of Kebrabasa country crosses the Zambezi and confines it within a rocky dell of a quarter of a mile in breadth, from which the slopes of the mountains rise precipitately for some 3000 feet. Mount Morumbwa, near the top of the gorge, with sides at an angle of 70 degrees and from 2000 to 3000 feet high, has pot-holes at 100 feet above the present low water. In the upper portions of Kebrabasa, ranges of lofty mountains stretch from the north-west. The chief rock is syenite, while the metamorphic rocks are contorted and thrown into every conceivable position. In the dry season the stream runs in a narrow and dark groove not more than 40 or 60 yards wide. The range is from 35 to 40 miles in breadth, the greater part of the river's course being broken by turbulent and dangerous rapids, but as the water rises 80 feet in the gorge in the floods, navigation will be possible for part of the year.

The latest map issued by the Chartered Company states that the total fall in this cañon is no more than 150 feet.

Above the gorge the river opens out on the Chikova plains, and assumes the same appearance as at Tete, with sedimentary rocks. Near by is the town of Zumbo, 550 miles from the coast, and not more than 800 feet above sea-level—an average fall, Kebrabasa included, of not more than 1·5 foot per mile.

The Middle Reach.—From the Kebrabasa to the lower end of the cañon of the Victoria falls, a span of 600 miles, may be called the central portion of the Zambezi. Parts of this are of great beauty, peaceful and enticing, fringed by a narrow belt of dark and shady trees, the banks cultivated in terraces by the lotus-eating natives, with waters teeming with fish, and which still afford undisturbed retreats for hippopotamus.

In places, however, the stream flows with a furious current through narrow and gloomy gorges, including the Kariba, formed by its passage through a range at the junction of the Sanyati. Dr. Livingstone, who made the passage down in a native canoe, claims the Kariba, as well as the Victoria falls, as the result of sudden fissuring. This portion below the falls has an average drop of 2·2 feet per mile.

The higher portions of the plateau circle round this central basin from the Kebrabasa range to form the upland country of Matabeleland to the south and the Tanganyika plateau to the north, with altitudes of 4000 feet, to join again at the Victoria falls. From these higher watersheds the tributary rivers fall rapidly and have eroded large basins in the coal-bearing rocks, separated from the Zambezi river by parallel ranges of hills, through which they pass in deep and narrow gorges.

The westward erosion of this central basin through which the Zambezi flows was checked by the thick sheet of volcanic rocks that underlie the Tertiary sandstones of the Batoka plateau. Over this stubborn and unyielding wall the Zambezi drops some 400 feet as

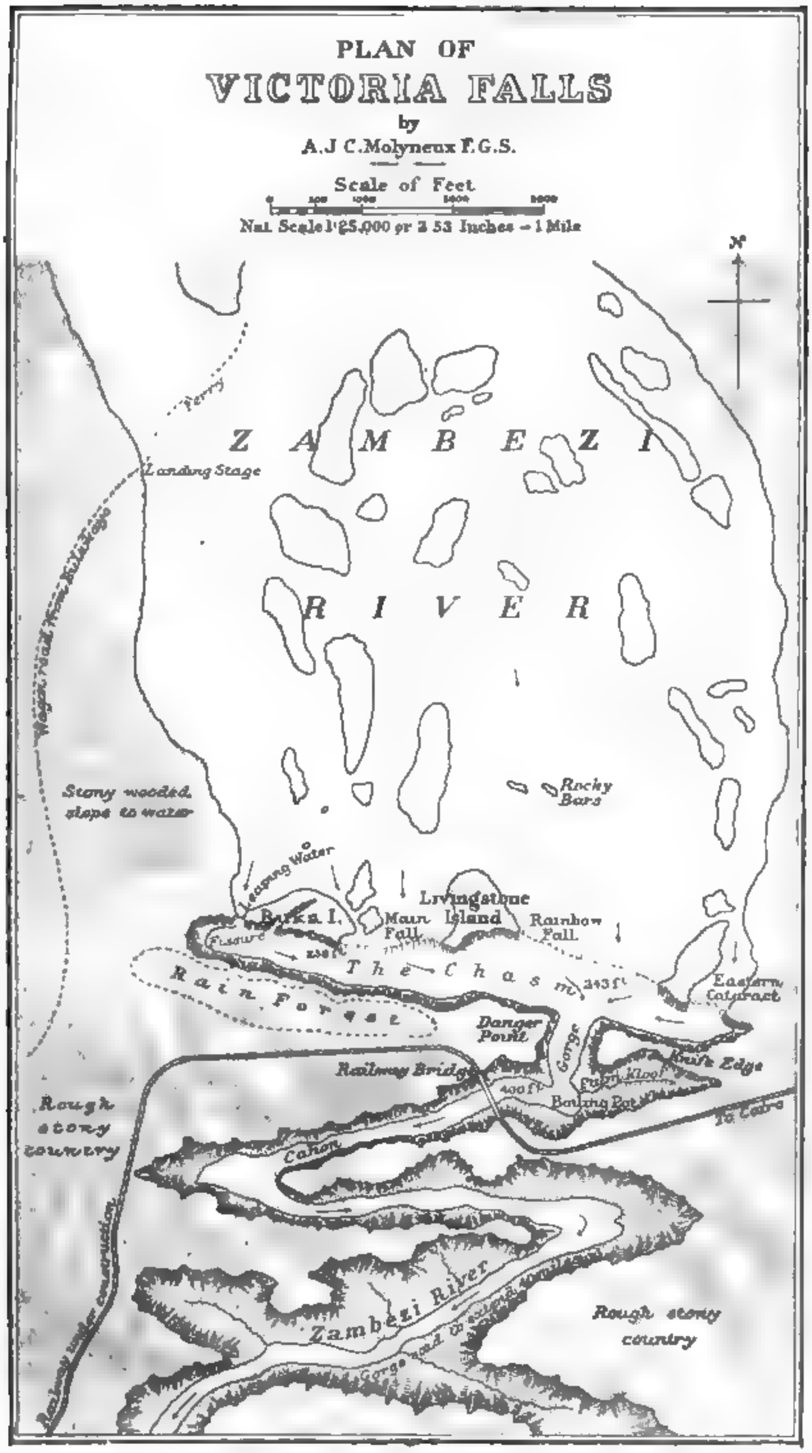


FIG. 1.—PLAN OF VICTORIA FALLS.

the Victoria falls, besides having a rapid descent of some hundreds of feet additional during its course through the 40 miles of the cañon. Between the central reaches and the level above the falls there is a difference of about 1000 feet.

The Upper Reaches.—From the falls to its sources, a distance of 800 miles, are the upper reaches of the Zambezi—a region of singular beauty, with navigable waters for the greater part of the distance. The country is open and undulating, and it might be said that the river runs along the very top of a plateau of 3500 feet in altitude, for the difference between the water-level and the surrounding country is very slight. The basalt sheet of the Victoria falls extends many leagues to the west, and the river, having eaten through the soft overlying sandstones, has reached the upper level of this sheet to then find that its deepening action is checked. But little lowering of its bed is therefore taking place, and until the cañon of the Victoria falls eats its way back to the western edge of the volcanic strata, the upper river must always be the wide, low-banked, and slow-moving stream it now is.

The Victoria Falls.—Livingstone, the discoverer of the Victoria falls, gained his first sight of them from an island in mid-stream on the actual edge of the chasm—a position from which no subsequent white man has gained his first impression. Seen from either bank of the river, the spectacle is majestic and awesome; but from this point, on a small island balanced as it were on the quivering precipice, the foam dashing on either side of him, the grey depths of the chasm beneath, and with the sunshine and rainbow and mist overhead, the view must have been infinitely weird and impressive. The discoverer, in describing the phenomenon, claims that "the falls are simply caused by a crack made in a hard basaltic rock from the right to the left bank of the Zambezi, and then prolonged from the left bank away through 30 or 40 miles of hills."

On his second visit, in 1860, with Dr. (now Sir John) Kirk and his brother, Charles Livingstone, a more careful investigation was made, but the same vigorous theory was maintained. It was admitted that Niagara has been formed by a wearing back of the rock over which the river falls, with a gradual recession through long ages, "but," it was stated, "the Victoria falls have been formed by a crack right across the river in the hard black basaltic rock which then formed the bed of the Zambezi. The lips of the crack are still quite sharp, and are about 3 feet from the edge. . . . The walls go sheer down without any projecting crag. . . . When the mighty rift occurred, no change of level took place in the two parts of the bed, consequently the water suddenly disappears." The zigzag course of the gorge below the falls and the whole length of the grand cañon is accounted for on the same theory.

The Livingstonian hypothesis was accepted by each subsequent

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FIG. 2. VIEW ON THE ZAMBEZI, LOOKING DOWN STREAM TOWARDS THE FALLS.

traveller. Thomas Baines and James Chapman saw the falls in July, 1862, and refer to no other theory. Edward Mohr (7, p. 320) visited them in June, 1870, and the lateral chasms suggested to him the thought "that awful convulsions of the Earth's crust must once have taken place here to produce such results." Selous (5) attributes the vent to some convulsions of nature, and no later writers suggest any other causes.

Livingstone had such an understanding of the natural features of South Africa, and sketched the broad geological and geographical problems with such a skilful hand, that it is with great diffidence that I suggest, in this particular case, other causes than the sudden rending of the Earth to account for the phenomenon of the Victoria falls. Yet I hold the firm conviction that here, no less than at Niagara, the combination of cañon, gorge, chasm, and falls is due to the ever-reducing action of moving water, eating back with relentness energy, year by year and age after age, into the hard and stubborn wall of igneous rock.

For those who desire to read poetical impressions of the falls, reference need only be made to the early descriptions of Dr. Livingstone, in his first book (1), and the collaborated results of his second visit (2); to those of Thomas Baines (3), of James Chapman (4), or to the later word-pictures of Mr. E. F. Knight. But for the purposes of this paper the phenomenon must be described, not so much as an object of beauty as with regard to features that must be later called in evidence for geological investigation.

Before giving a short description of the falls, it is very desirable that some caution should be used in selecting names for the different features, and, if possible, the early nomenclature, where suitable, should be restored and perpetuated. Some of the names already allotted by visitors are particularly unsympathetic or inappropriate. "Devil's cataract" and "Devil's island" are fast becoming the accepted names of the foaming western cataract, again exemplifying that inexplicable sentiment which invokes the devil's sponsorship for beautiful features in all parts of the world. Baines called this "The Leaping Water," surely a more pleasing term, and the island became known to him as "The Three-rill'd cliff." For this latter, "Boaruka island," the native designation (according to Livingstone), is more appropriate. "Danger point" for the rock overlooking the exit from the chasm is descriptive; but "Lovers' walk" for the glorious Palm kloof is too forbidding, especially as no "lovers" had been known to have put in an appearance at the falls, and the term can have been only anticipatory. "Palm grove" or "kloof" is becoming more used, and I submit that the South African word "kloof" is more applicable.

In this paper I shall apply names as follows: "The Chasm," is the cleft into which the river falls; "The Gorge" (that is, the *throat*), is the exit as far as the "Boiling Pot;" and then the "Grand Cañon' commences and extends for 40 miles.

Geology.—During a late phase in the geology of the country, which is probably referable to the Tertiary period, South Central Africa was subject to vigorous volcanic action, the concrete forms of which can now be seen in the denuded and exposed areas of lava-flows existing in the Limpopo and Zambezi valleys.

One basalt sheet lies between Wankies coalfield and the falls, and will be noticed when travelling on the railway. It is coincident with the country at one time owned by the Bakota tribe, a race of industrious iron-workers, and recently almost decimated by the raiding Matabele in Lobengula's days. This volcanic outflow might well be known as the Batoka basalt. The igneous sheet is seen in the cañon to occur in alternating flows of compact and of highly cellular and amygdaloidal basalts. In many other localities the basalt is interbedded with the soft forest sandstones, but in the falls district the overlying stratum has been eaten into by the Zambezi and the tributary streams, until the basalt sheet has been reached, and now all the rivers of the district flow over hard igneous beds, while the upper strata of soft sandstones form gentle slopes and afford a hospitable soil for the graceful forest trees that clothe them. This alternation of rocky valleys with only stunted and shabby trees, and the luxuriant growths of the higher sandy slopes, is a distinctive feature on the railway, and is repeated along the Zambezi valley. These beds of hard rock and buff and red sand extend far to the west. At the confluence of the Linyante, some 50 miles above the falls, Livingstone describes an island named Mparia, which is composed of "trap containing crystals of quartz encrusted with green copper ore (amygdaloids?) (1, p. 339); while the Gonye falls, 120 miles still further north-west, are stated to occur in a deep fissure in sandstone, 100 yards wide and several miles long (1, p. 167), the bed, according to other travellers, being formed by masses of basaltic rock.

The Falls in Detail.—Rising at a distance of 1900 miles from the east coast, joined by the Lungwebungu river that has its source within 400 miles of the western ocean, augmented by the water soaking from the "sponges" of the distant Barotse valley and the outfall from the swamps and wide lagoons of the Linyante river, the Zambezi, long before it reaches its purgatory of the falls, is a noble and expansive river, flowing in a wide valley, bounded by the distant and low hills of red and forest-clothed sand. For many miles above the cataract its bed is the level igneous sheet above described; its blue water is dotted with verdant islands of the same rock; and where rapids occur, it is the same hard basalt that impedes its course, and over which the waters churn and boil.

Below the old site of Sekota's kraal the river is at its widest, the islands are most numerous, and the water is most in repose. Sailing down this most beautiful reach, there is no evidence except the

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Fig. 4. VIEW LOOKING INTO CHASM FROM ITS WESTERN END.

The "leaping water" is on the left, Boaruka Island with its new rift cascade is in the centre, and the cliff to the right is crowned by rain forest. The illustration also shows the rainbow, the columnar cleavage of the rock, and débris of the cliffs.

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Fig. 5. THE GRAND FALLS.

At high river this is one expanse of falling water, but now separated into numerous cascades in the crevices of the rock. Note the continuance of the river level to the very edge of the falls.

distant gossamer veil of rising spray (Figs. 1 and 2) to show that the river does aught else than pursue a quiet course. But beneath the pillar of spray is the chasm put like a snare across the river's path to trip it into the pitfall below. There is no lack of evidence to show that the ancient course, before it had bitten deep into the earth, was along the higher level of the lava-sheet. At the confluence with the Mlamba, just above the first rapids, is a wide expanse of river alluvium, with the banks of the smaller stream 10 or 15 feet above its present level, showing gravel with basalt pebbles, and in the converging valleys of the Makone, and other watercourses above the falls, there are beds of tufa containing fluviatile shells. Also I have found shingle of water-worn agates from the amygdaloidal basalt at a distance of 15 miles from the cataract, at an even higher level than the Zambezi now occupies above the falls. Livingstone found other evidence of high-level river terraces lying some 200 feet above the Zambezi at the falls (1, p. 945), and considered it as showing that the whole country between the Lekone and the Libebe in the west was formerly one fresh-water lake, drained by the sudden fissuring of the basalt sheet. The small altitude of the plateau above the river supports the idea of the inland sea, for, as I have said, the river seems to run along an almost level surface on the top of the Barotse plateau.

The chasm across the river (taking the measurements ascertained on Livingstone's second visit) is little more than 1860 yards long—the same as the breadth of the river—that number being fixed upon as indicating the year in which the falls were first carefully observed. The lip of the falls is subdivided by natural features as follows:—

Nearest to the right bank is the misnamed "Devil's cataract" (Leaping Water of Baines), 36 yards wide (2, p. 152)—a sloping mill-race that carries much water when many other portions are dry at low water. Next comes the island of Boaruka, about 200 yards wide, cut by a stream and fissure through which water pours at flood times (Fig. 4); then comes the great fall 573 yards broad divided from a second fall of 325 yards by a projecting rock. At the east end of this fall is Garden island, now known as Livingstone island, lying on the very edge of the precipice some 1170 yards from the west side and 600 yards from the east shore. At the end of the chasm is the Eastern cataract, a mill-race something similar to the "Leaping Water." This part of the falls east of the island is mostly bare in the time of low water, and then gives passage to many isolated and narrow streams (see Figs. 5 and 6). The west end of the chasm is but 256 feet deep as measured by Mr. Mansergh, the railway engineer, increasing to 343 in depth at the orifice of the chasm, and increasing to 400 feet below the Boiling Pot. The chasm near each end is not more than 80 or 100 feet wide, increasing to 240 feet in the centre.

The water dropping over the falls nearest the banks has now to turn

at right angles and run the gauntlet past that falling over the centre, for the only outlet is the gorge of about 100 feet in width. Here again the right angle is in evidence, and the southerly course is now resumed. But not for long: 130 yards further it enters the Boiling Pot, and emerges therefrom to run in a trench of 1170 yards long parallel to the first. Only the portion of this parallel trench west of the Boiling Pot is occupied by the stream, the eastern end being now dry, and nursing in its moist, warm, and sunlit depths the coolest and most enticing vegetation of the Palm kloof. This end is divided from the chasm by a very narrow ridge of rock called the Knife Edge, the western end by a wide promontory (on which river pebbles can be found) with a base 416 yards wide, now carrying the Rain forest. To my mind this is an old falls chasm dating from a time when the river passed over the ridge now occupied by the Rain forest promontory, Danger Point, and the Knife Edge, the depression at the east end of which is the extension of the Eastern cataract.

At the land end of the Rain forest promontory the cañon takes a bend at an acute angle to the east in a third cleft, then glides round a third promontory to form a fourth chasm running westwards. Beyond this the zigzag course continues, and little is then known of its vagaries through the 40 miles of the Grand cañon.

All down the valley the tops of the cañon escarpments lie at the same remarkable level as the lip of the falls, the river now running at a level of 400 feet lower than the surface of the basalt sheet. One strong argument against the fissure theory is that every lateral stream and tributary, such as the Masuye, Matetsi, Makone, and the one near Tsherus, after a level course along the lava-sheet, enters the cañon by a deep ravine or "chine" that is being cut back by the same processes which now influence the shaping of the falls. Indeed, the fall of the Masuye river into the cañon is quite worth a visit, the small stream having a sheer drop of about 300 feet.

The confluence of these lateral kloofs, or chines, with the Grand cañon is constantly occurring throughout the whole 40 miles of its course, a fact which makes a journey of investigation extremely arduous, each precipitous gully having to be circumvented, causing many hours' and even days' delay in returning to the main cañon.

As a rejoinder to a theory occasionally advanced, I may say that there is no evidence of the erosion of the chasm, gorge, or cañon having been assisted by the pre-existence of dykes or veins of softer material. Remains or traces of such would exist at either end of the chasm or the Palm kloof, and none can be found.

The Processes which formed the Victoria Falls.—Let us now consider the details of the scheme by which nature sculptured these features, processes which we may learn by observation of present-day conditions.

As before stated, the river has removed the upper strata of fine

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FIG. 6. VIEW OF FALLS SEEN THROUGH THE JAWS OF THE GORGE.

sandstones, and consequently the level of the stream, the lower flats of the valley, the ends of the chasm, and the edges of the gorge and cañon can be seen to be of the same horizon of basaltic rock. The apron of water and inaccessibility prevent one seeing if the hard top sheet extends in depth for the whole 400 feet of the chasm, but down the cañon (Fig. 9) it can be noticed that the lava does lie in beds in varying thicknesses. The examination of these strata is not possible unless one is slung over the precipice, a feat not yet attempted. The hard surface is a basalt more or less amygdaloidal, on the degree of which quality depends its want of tenacity.

As is common to all rocks of this nature, it is full of cracks and fissures due to contraction on cooling, and though it does not assume the perfectly regular hexagonal columns of the Giant's Causeway or of Staffa, yet it frequently resembles them (Fig. 7), the vertical cracks producing a general columnar form. The columns thus defined may be seen when the water is low, along the lip of the falls, and beneath the clear and rushing current of the "Leaping Water" (Devil's cataract), more or less truncated as the verge is reached, and bearing but little evidence of attrition. Indeed, evidence of actual wearing away of the angular edge of the precipice is conspicuously absent, and, as Fig. 5 will illustrate, the level of the stream is almost unchanged up to the very lip of the falls. Only at the two cataracts at the ends of the chasm can the process of trituration be called in aid as a demolishing agent, and even here it is probable that the columns have been truncated by the action of the rushing water forced into the horizontal joints.

My opinion is that the cutting back of the edge is due to the perpetual hammering action of the vast bodies of water falling into and down upon the cracks between the basalt columns, assisted by the constant vibration of the rock from the precipitated masses of water, and that by this constantly exerted force the columns are rent asunder and fall into the chasm, taking with them huge and deep flakes of the precipice (Figs. 4 and 7). At low water heaps of these blocks, as yet angular and unreduced, may be seen in the shallower ends of the chasm (Fig. 4).

While there are signs some distance away that the basalt flows are bedded in various degrees of tenacity, there is no sign of undermining of the rock that forms the rim, as at Niagara, and so leaving that rim without support; rather does the lower portion of the precipice at places protrude outwards. But the breaking down of the rock is mostly columnar, hence the almost vertical walls of falls, chasm, gorge, and cañon.

Such I believe to be the causes that have played the most important *rôle* in the trenching of this length of 40 miles or so. To estimate or arrive at any approximation of the time that such work has taken is hopeless until points be accurately fixed by which to register the

retrocession of the falls in stated intervals. The rate must depend upon the resistance that the columns on the verge offer to their destroyer, and that we cannot yet surmise, for since Livingstone's discovery until a few years ago visitors were few in number, and a second visit was such a rarity that any alteration in the falls has not been noted. When Baines visited the falls in 1862, he painted the canvases that are now in the Royal Geographical Society's room, and it may be that some day his pictures may assist in appreciating changes in the falls.

At Niagara these changes have been observed, more or less, since they were sketched by Father Hennepin in 1697.

The Niagara and the Zambezi falls each possesses its own distinctive grandeur, and they have so few spectacular features in common that comparison of their beauties is particularly inappropriate. But there are several points in regard to the physical features of the two falls that merit notice. Above the falls, the Niagara river runs over level country that is nowhere more than 30 to 40 feet above its banks until, a mile above the cataract, it becomes embroiled in rapids and descends in the intervening distance some 50 feet, to drop a further 165 feet perpendicularly over the shelving lip of the falls. From the open and broad pool at the foot of these the water runs off in a narrow chasm, 200 to 400 yards wide and 300 feet deep, for a distance of 7 miles, when it enters the quiet waters of Lake Ontario. Like the Zambezi, it has its whirlpool in the gorge, from which the water swirls away at a right angle to its former course.

The Niagara falls are caused by the undermining of a lower bed of soft shale, by which the harder bed of limestone that forms the lip is robbed of its support and falls in large blocks into the bowl beneath. We are told that the sudden descent of huge fragments of the undermined portion in 1828 and 1818 shook the ground like an earthquake. We have as yet no such recorded falls of rock or noticeable recent indentations on the Zambezi to assist in our estimations of time. In the case of Niagara, Sir Charles Lyell conceived that the lip might be conjectured to be eaten away at about one foot per annum, giving a period of 35,000 years for the 7 miles of gorge, while Prof. J. W. Spencer (9) arrived at the figure of 31,000 years. At the same rate, the 40 miles of cañon below the Victoria falls would represent a career of close upon a quarter of a million years, but, as I have already said, there is as yet nothing upon which such calculation can be based.

The Grinding Down of the Cañon.—The process described accounts for the breaking down of the chasm of the Victoria falls above the water-line: another power is at work in the depths below. During the winter, when the water in the chasm is some 40 feet lower; when the mist-veil is lighter, or when it is blown aside so that the eye may penetrate the grey depths of the abyss, the vast blocks that have fallen

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FIG. 7. VIEW LOOKING INTO CHASM FROM ITS EASTERN END.

Vertical wall of "knife edge" on the left. Columnar structure of the basalt clearly shown in the rocks on the right, débris of broken down blocks at bottom of chasm.

from the lips and side are seen amidst the foam, black and jagged in the angry water (Figs. 4 and 7). These are constantly on the move, grinding themselves and the rocky bottom as irresistibly as the Alpine glacier, and deepening the channel of the chasm until, on entering the gorge, they disappear beneath the eddying torrents to carry on their constant triturating work unseen. After gyrating in the Boiling Pot, some of these blocks, reduced and rounded in shape, are brought ashore in the back eddy at the end of the Palm kloof, but in large numbers they are carried and deposited in the corners of the cañon, or in the far-off shingle beds of the placid reaches of the middle river. I have collected perfectly elliptical pebbles of the amygdaloid rock at a point 100 miles below the falls.

This sub-aqueous grinding action of the unseen and moving blocks is the second process in the trenching of this mysterious and tortuous canal, a deepening action that is incessantly going on, and which is yearly increasing the difference between the upper level of the river and the gloomy swirling stream lying in the depths of the unapproachable cañon.

Causes of the Zigzags.—With these explanations of nature's wonderful, if simple methods, the geologist will not be permitted to leave the subject; other pertinent questions now arise. Foremost of these is the oft-repeated one, What caused the zigzag course of the gorge and cañon? and if not by a sudden rending of the earth along lines as angular as the lightning's flash, what motives have influenced the present sinuosities of the later-day stream?

I have already claimed that the cutting down of the chasm is solely due to the continuous thrust of the rushing water among the joints of the basalt. Admitted that such is the case, it is obvious that only those portions of rock that are subject to the force of the current must be liable to this flaking action. In my opinion two features are responsible for directing the action of the eroding forces, and they are, the position of the many islands that must, as now, have studded the broad river in its former course, and also the lines of weakness in the basalt along what may be called the master joints or faults. These occur in all rock formations, and are independent of and cut across the subordinate columnar crevices of the falls lava.

If the intruding water finally rends asunder the more local columnar joints, its action will be no less successful in eating its way into and down the main fissures of the country rock, cracks that extend for long distances. Looking at Boaruka island beyond the cataract (Fig. 4), it can be noticed that a stream cutting through the island is falling down a cleft which it is widening in a striking manner. The stream falls down this narrow slit for about the height of the falls, and it can easily be conceived that with the flaking of the basalt therein, in the manner described, there are probabilities of this cleft widening and

receding back in a direction that is diagonally across the present course of the river, and, peculiarly enough, almost parallel to the first arm below the gorge. The erosion of this crevice must be slow at first, but as it recedes back the amount of water intercepted and deviated from the main falls must increase in rapid ratio. It would thus appropriate millions of tons of water that would otherwise proceed to fall over the precipice, of which portions would thus become dry and consequently free from the beating-down action of the stream. A new direction for a strong current is thus set up, the chasm yearly becomes of greater magnitude, and at last attains the grandeur of the main fall. In this manner is probably due the acute angles of the cañon.

The other feature which will influence the future direction of the currents, and therefore of lines of erosion, is the distribution of islands. Relying on my belief in the irresistible action of the flowing water over the rim of rock, such parts as are sentinelled by islands must be proof against decay. To-day there are three important islands on the lip of the chasm, and more than fourteen large ones in the 4 miles of river above the falls, and the power of the water is confined to the channels between. The two cascades at each end of the chasm, influenced in their courses by the islands adjoining them, are now deeper than the lip of the falls, and consequently the water passes down them in great quantities at a time of the year, the dry season, when the lip of the main cascade is but a series of isolated waterfalls. There must, therefore, be more prolonged submission to the moving currents in these channels than at the places that are periodically dry, and the only result can be their deepening, and a growth in importance year by year. In this case there would be formed a long sloping by-wash commencing many yards back, and drawing the river into the present chasm by a rapidly descending series of rapids or cataracts. This may account for the long straight reaches that occur many miles further down the cañon.

With these influences at work—and there is no reason to think that they are different to those which mapped the falls—these peculiar angles and straight runs in the cañon may be explained. There are reasons for believing that, at one time, the former chasm was what is now the ravine known as the Palm kloof, connected with the Boiling Pot, and the adjoining part of the cañon. That the river previously flowed over the Rain forest promontory at the upper level has already been shown, and additional evidence is found in the fluviatile *débris* recently encountered in constructing the railway and approach to the bridge.

The narrow promontory known as the Knife Edge, separating the old chasm from the new, has a depression at its land end and a high mound at its extremity, and, from visual observations, this high end seems to have been one of the ancient islands that deflected the extension of the eastern cataract into the Palm grove. The current

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FIG. 8. VIEW FROM SECOND EASTERN PROMONTORY OVER DEPRESSED AND NARROW PORTION OF "KNIFE EDGE," WITH FALLS BEYOND.

may then have continued across the Rain forest table to fall in as a grand cascade, or have run down the old chasm in the form of the sloping rapids that I have shown are growing at the "Leaping Water."

The Falls have checked the Deepening of the Upper Zambezi.—The Batoka basalt extends to the lower end of the Grand cañon, and it may be understood that its eastern fringe would be thin. The backward erosion of the Zambezi from the middle reaches would quickly break into it, but as the thickness of the basalt increased as the river receded westwards, the cutting action would become slower, until the rate of deepening of the middle reach and the cleaving of the barrier of the Kebrabasa rapids far outstripped the slower process of forming the Grand cañon. The result was that the difference between the level of the Zambezi along the top of the basalt sheet at the falls and the altitude of the central reach became more exaggerated as time passed.

In the future this difference must even increase. The basalt sheet extends many leagues westward from the falls, and the bed of the river has cut but little into it since the erosion reached that horizon; for, except in the flood season, the water is beautifully clear and carries but little suspended matter to aid the triturating action. It pushes no boulders along, and the wide reaches of quiet water aid the precipitation of sediment even in flood times, while in winter its clearness and transparency is remarkable. The surface of the basalt sheet is peculiarly level for many miles, and the extent of the wearing down by the river is not more than 20 or 30 feet below the upper surface of that rock.

From the foot of the falls conditions are different; the water is confined within narrow walls, and rushes on with impetuous force, carrying blocks and boulders that must incessantly grind and reduce the already deep bed of the cañon.

Thus the hard and stubborn basalt has prevented the lowering of the upper reaches since first the river met the eastern fringe, and commenced the chiseling of the groove of the Grand cañon. Until the cañon is cut back to the further side of the sheet, no such lowering can take place, and the upper reaches must continue to run, as it were, along the top of the country and amid low-lying hills.

But for this natural weir of basalt that retains its upper waters, the Zambezi might have cut deep into the surface, and become navigable far into the interior. The influence of the falls on the geography of South Africa has therefore been very great.

The Spray Clouds and the Rainbows.—No mention of the Victoria falls would be complete without some reference to the eternal columns of mist that rise from the grey depths of the chasm, or to the brilliant effects of the rainbows that irradiate them. As the vast masses of foaming water are precipitated, with the constant roll of thunder, into the

abyss, they are broken up into comets' tails, again into spray, and still again are comminuted into driving mist. The air forced down with them sets up a current along the cañon, and, ascending in eddies in the chasm, carries with it the spindrift of the dashing spray, and rises in vapoury clouds and columns far above the falls. Baines, in July, 1862 (3), measured the height, by sextant, to be 1144 feet and 1194 feet above the bottom of the gorge; and Edward Mohr, during his visit in the month of June, 1870 (7), calculated that they rose 1055 feet, or 655 feet above the river. The mist-clouds rise higher in the coolness of the early morning than in the noonday heat, while at the time of high water the spray nearly envelops the whole length of the falls.

The column of mist can be seen from a great distance, when open views in the undulating country permit, or higher points of vantage can be gained. From the hill east of the Matetsi river, 40 miles away, it is especially noticeable against the red gleams of the sunset as a dark, smoky column spreading out in an upper layer, while from other places, and at midday, it is of dazzling whiteness. At sundown, looking from the west, the ruddy glory of the afterglow warms it up with orange and tints of flesh-colour, and seems to quicken it into a blithesome guardian of the falls.

It is to this constantly lifting and rolling veil of spray that the Victoria falls owes its most peculiar and elusive charm. No clear and complete view of the depths and distances of the chasm can ever be obtained; the mist throbs and moves across the scene, dimly revealing and again hiding innumerable changing sights. Thus there is always the suggestion of shadowy beauties beyond this gossamer veil; a feeling that we but just touch the glories of this earthly paradise, yet shall never grasp and understand them, stay we never so long.

And amidst this sunlit vapour is born the crowning spectacle of the falls. At every turn and in every view of the water, green foliage, and dazzling foam, the glorious double rainbow follows one, whether in the rich prismatic colours of the daytime or the neutral tints of the moonlight. What wonder that the more ancient native term was, as Livingstone tells us (2), Seongo, or Chongwé, "the place of the rainbow"? For here surely all the rainbows of the world must come to play in the sunlight, before they follow the thunderstorms across the land to bless the rain-chilled beasts and birds.

To the condensing vapour is also due the rich and ever-green Rain forest and the trees of the Palm kloof. This vegetation includes a wealth of ferns, orchids, and palms, rich treasure for the botanist, who must, however, be prepared for the quick and thorough wetting from the never-ceasing rain that descends from the foliage above. Through a framing of dark-green leaves choice pictures of dazzling, foaming

Photo by Pedrotti, Bulawayo (Copyright)

Fig. 10. **VIEW IN RAIN FOREST.**

water will be his reward, and the quiet shady cloisters of the forest are not the least of the beauties that everywhere present themselves.

Beyond the end of the Rain forest the bare promontory of Danger Point lies basking in the sun. Standing here, one may gain a closer idea of the extent of the falls. Far in front is the open blue water of the unsuspecting river, that nearer hurls its fleecy masses across the chasm to one's very feet, and amid the lifting mist-clouds are glimpses of pleasant places, as fleeting as sun-lit dreams. From the grey turmoil of the gorge below rises the continuous diapason of rumbling thunder, grand chords and voices are in the air, and under the deep-blue skies the might and majesty of the falls sink deep into one's soul. With the homage-paying native who comes here to worship the deity, we too must feel the mysterious Presence, and that here, amongst the grandest of nature's works, we stand upon the threshold of the "tablelands of God."

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(3) 'Explorations in South-West Africa, 1861–1862.' Thomas Baines, F.R.G.S. Longmans. 1864.
(4) 'Travels in the Interior of South Africa,' James Chapman, F.R.G.S. Stanford. 1868.
(5) 'A Hunter's Wanderings in Africa,' F. C. Selous, C.M.Z.S. Bentley. 1895.
(6) 'Seven Years in South Africa, 1872–1879,' Dr. Emil Holub. Sampson Low. 1881.
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(8) 'Travels in North America,' Sir Charles Lyell, F.R.S. Murray. 1845.
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THE EIGHTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

By HUGH ROBERT MILL, D.Sc.

THE Eighth International Geographical Congress differed from its seven predecessors by the fact that it was held in a continent, and not in a town. The scientific meetings took place in Washington, New York, Niagara Falls, Chicago, and St. Louis, while the informal meetings and excursions included also Philadelphia, the Grand Canyon of Arizona, and extended into Canada on the north and Mexico on the south. The itinerant character of the Congress had advantages and defects; on the whole the latter seemed to outweigh the former, and the experiment is not one likely to be repeated, at least in the form

tried in America. It is certainly advisable to combine long excursions, carefully planned and conducted by able specialists, with the sedentary routine of scientific meetings; but the attempt to hold several sets of scientific meetings arranged by different local officials in various places did not work very well. The members of the Congress did not all make the complete circuit; each town had its own group, and the foreigner had no time to familiarize himself with the new places and people before he was swept on to the next. The inevitable discomforts of frequent change of quarters was apt to induce a certain amount of irritation in those who were unfamiliar with the ways of American hotel and railway life, and who consequently could not anticipate the situations in which they found themselves, nor always make the best of them as they arose. Still, no one could fail to be struck with the earnestness of the organizers of the Congress, who worked untiringly, and with the generous hospitality both of the institutions and the individuals responsible for the meeting.

The local arrangements were not so elaborate as at London or Berlin, but this was due in part, at least, to the short duration of the meetings in each centre, and to a certain extent to the fact that special arrangements for duplicating programmes and proceedings in two different languages, indispensable in Europe, were not required in America, where practically all the members present were acquainted with English. It would have been unnecessary to touch on these matters even lightly were it not that the meeting was an experiment, from which the conclusion may justly be drawn that the scientific part of such a Congress should be held in one place, and the excursions be devoted entirely to the more important and valuable purpose of seeing the country and forming friendships with kindred specialists in comfortable conditions under expert leadership.

The Congress was under the Honorary Presidency of the President of the United States, an unusual distinction for such a gathering in America. The President of the Congress was Commander R. E. Peary, U.S.N., who, with Mrs. Peary, was indefatigable in carrying out all the heavy duties of that position in all the cities visited. The diplomatic representatives in Washington, the surviving Presidents of former Congresses, and the "presiding officers chosen by host societies," viz. G. K. Gilbert (National Geographic Society), Henry G. Bryant (Geographical Society of Philadelphia), R. E. Peary (American Geographical Society), and R. D. Salisbury (Geographic Society of Chicago), were Honorary Vice-Presidents. The general secretary was Mr. Henry Gannett, and the treasurer Mr. John Joy Edson. For the purpose of considering proposals submitted to the Congress, the delegates of foreign geographical societies were invited to assist the Presidency or executive committee of local geographers.

The Congress assembled in Washington, and the proceedings opened

on the evening of September 7, with an informal reception in the Gardiner Hubbard Memorial Hall, the home of the National Geographic Society. On this occasion a welcome was extended to the visitors by Mr. G. K. Gilbert, acting-president of the host society.

On Thursday, September 8, the formal opening meeting took place in the George Washington University. Prof. C. D. Walcott, director of the United States Geological Survey, gave an address of welcome on behalf of President Roosevelt, who had hoped to be present personally, but was prevented. Mr. G. K. Gilbert spoke on behalf of the National Geographic Society, and M. Henri Cordier, Prof. Albrecht Penck, and Mr. Yule Oldham responded for the visiting delegates. Commander Peary then delivered his presidential address, in which he dealt specially with the future of polar exploration, urging that more care be given to organization and equipment, and less thought to relief expeditions, for in such work "the loss of a ship or a few men must be discounted." The meeting terminated after Prof. de Claparède had invited the Congress to Geneva, and Dr. Béla Erödi to Budapest for its next meeting.

The afternoon was spent in visiting the various Government bureaus in Washington, under the guidance of special committees.

At night a very successful reception was given at the Naval Observatory, where the guests were received by Admiral and Mrs. C. M. Chester. At midnight, by special arrangement with the cable companies of the world, a telegraphic time-signal was despatched to all the national astronomical observatories, followed by a message of greeting from the Congress. Next morning replies were read from Greenwich and most of the other observatories in Europe, Asia, Africa, Australia, and America; the Adelaide observatory acknowledged the nearly simultaneous receipt of the signal *viâ* the Pacific and *viâ* the Eastern cables. The Guam observatory replied by an invitation to hold the next Congress in that remote American possession.

Friday was set apart for the reading of papers in general session in the forenoon, when papers on Government Surveys were read, and in sections in the afternoon. The sections dealt with "Physiography," under the chairmanship of Prof. Davis; "Biogeography," with Prof. Heilprin as chairman; and with "Geodesy and Geographic Technology," Mr. J. F. Hayford presiding.

Saturday, September 10, was entirely devoted to the sections, when in addition to Physiography and Biogeography, meetings were held for the consideration of papers on Glaciers, with Mr. H. F. Reid in the chair; and on Meteorology and Terrestial Magnetism, under the presidency of Prof. R. De C. Ward.

In the evening Commander and Mrs. Peary gave a reception at the New Willard Hotel, which supplied a welcome opportunity for the members to meet each other. An interesting excursion down the

Potomac to Mount Vernon was arranged for Sunday, the 11th, when a visit was paid to the tomb and the house of George Washington, the latter brought back as nearly as possible to the condition in which it was during his lifetime.

A late evening train brought a large number of the members to Philadelphia, where a day's sight-seeing had been arranged by the Philadelphia Geographical Society, and Monday, the 12th, was very fully and pleasantly occupied in this way. The arrangements throughout were admirable, and the day concluded with a charming banquet at the Country Club, when Mr. H. G. Bryant presided. In reply to his speech of welcome, the British, French, German, Hungarian, and Japanese delegates responded, their expressions of appreciation being received with the greatest cordiality. The National Anthem, after the speech of the delegate of the Royal Geographical Society, could hardly have been sung more enthusiastically in Canada itself.

On the morning of Tuesday, September 13, the Congress assembled in the splendid new building of the American Geographical Society in New York, when many new members joined to take the place of a large number of Washington members who did not come on. The Congress met in general session at 10 a.m., when Commander Peary welcomed the members in his capacity of President of the American Geographical Society. After a feeling appreciation of the late Prof. Ratzel by one of his lady students, Dr. Martha K. Genthe, Sir John Murray gave an address on Deep-sea exploration, and Count Pfeil on the Rise and development of the German colonies.

The afternoon was occupied by the simultaneous meeting of four sections: Oceanography, under the care of Prof. W. Libbey; Exploration, with Mr. H. G. Bryant as chairman; Economic Geography, under Mr. E. R. Johnson; and Educational Geography, under Mr. Charles R. Dyer. A fifth section on Volcanoes and Earthquakes, with Mr. C. H. Hitchcock as chairman, was appointed to meet after one of the others was finished. It was impossible for any individual to keep account of the progress of the proceedings in all the sections; but a number of papers in most of them appeared in the programme of the following day. In the evening a joint lecture was delivered by Dr. and Mrs. Workman on their mountaineering experiences in the Himalayas. At 9.15 p.m. a reception was given in the Society's house. In the midst of the business of this very busy day, time was somehow found for two meetings of the Presidency and the delegates of foreign societies to consider various questions before the Congress.

The report transmitted by the committee of the Berlin Congress was considered, and various resolutions were adopted. As the result of the deliberation was not officially printed before the close of the Congress, the following notes do not claim to be verbally accurate, nor are they complete, as it seems unnecessary to refer here to matters

on which it was decided that no action should be taken, while some resolutions were postponed until the questions involved had been dealt with in the sectional meetings.

Map of the World.—The report of the committee on a map of the world on the scale of 1: 1,000,000 was received. Thanks were expressed to various authorities in London, Berlin, and Paris for beginning to give effect to the committee's scheme, and it was agreed to represent to the United States Government the advisability of undertaking a general map of America on the same plan.

Polar Exploration.—With regard to Antarctic exploration, the meeting, after expressing satisfaction with the great advances that have been made since the Seventh Congress, adopted the following comprehensive resolution:—

"The Eighth International Geographic Congress, realizing that the only untouched fields for geographical discovery are the regions immediately surrounding the poles of the Earth, desires to place on record its sense of the importance of forthwith completing the systematic exploration of the polar areas. It is very desirable that the experience gained by men of science and officers in the recent Antarctic expeditions should be turned to account by following up without delay the successes they have obtained. The Congress recognizes that the Arctic regions possess a more immediate interest for the people of North America, and expresses the confident hope that the expeditions now being prepared will be so supported as to secure early and complete success."

Earthquake Investigation.—The Eighth International Geographical Congress sends its congratulations to the International Seismological Association, whose further work is waited for with much interest.

Bathymetric Map of the Oceans.—The Congress, in a motion the text of which is not available at the time of writing, expressed its cordial thanks to the Prince of Monaco for his completion of a map of the oceans showing all soundings in deep water, to Prof. Thoulet for exhibiting the map at New York, and to the Committee on the Nomenclature of sub-oceanic forms.

Rules for Geographical Names.—The Congress endorses the views of the Berlin Congress on this subject, and resolves that geographical societies be urged to give the rules wide publicity.

Collection of Records of Drift Ice.—The thanks of the Congress are to be sent to the Danish Meteorological Institute and the co-operating offices for their systematic collection of records of drift ice.

Transcription of Geographical Names.—This subject was postponed for the consideration of the Ninth Congress.

On Wednesday, September 14, the proceedings began with a meeting of the Presidency and delegates at 9 a.m., to consider the place of meeting of the Ninth Congress. Two invitations were before the meeting, and

these were urged by Prof. de Claparède and Dr. Béla Erödi with great earnestness. The discussion at times seemed to indicate that some of the delegates viewed the matter from a tourist's or a politician's point of view, but after the sense of the meeting had been ascertained informally, it was unanimously resolved to accept the invitation from Switzerland, and the Ninth International Geographical Congress will therefore meet in Geneva at a date to be afterwards arranged. A large programme of papers on Oceanography, Meteorology, Exploration, Economic Geography, Educational Geography, Volcanoes and Earthquakes was then gone through in the five sections.

The American Museum of Natural History co-operated with the American Geographical Society in providing accommodation for the various meetings, and each day a buffet lunch was served to members in the museum. A remarkable collection of ancient maps was on exhibition in the Lenox Library, and every facility was afforded for the inspection and study of the exhibits, of which a complete explanatory catalogue was published and distributed.

A dinner was given to the delegates of foreign geographical societies in the Hotel Endicott by the American Geographical Society, at the close of which the President, Commander Peary, announced that he had made arrangements for another attempt to attain a high northern latitude, and expected to sail in a new ship next year.

After two days so full of hard work, the hospitality of the American Geographical Society in providing a trip on the Hudson river for Thursday, September 15, was greatly appreciated. The day was cool and bright, with a fresh breeze, and the beautiful scenery of the Palisades and the hills bordering the gorge of the Hudson were seen at their best. Prof. W. M. Davis described the geographical features, and on the summit of Mount Beacon gave a fascinating exposition of the geographical history of the great landscape which lay open to the eye from that breezy height. At sunset a parade of the cadets at the United States Military Academy at West Point was held, and after witnessing the evolution of these splendidly drilled youths in their picturesque early nineteenth-century uniforms, the party, still guests of the American Geographical Society, entered a special train of Pullman cars which was to be their home until their arrival at St. Louis.

Friday, September 16, was spent at Niagara Falls, the forenoon in individual rambles through the Island Park, and then, after a brilliant lecture on the falls by Mr. G. K. Gilbert in the Opera House, a circular trip was made on the electric cars around the gorge. The tremendous works for the new electric power-house on the Canadian side were well worth seeing, though they have (temporarily it is to be hoped) destroyed the beautiful Victoria Park. A less excusable blemish on the Canadian side was a gigantic advertisement disfiguring the whole view, and sufficient by the grossness of its inappropriateness

to make every British subject for ever forswear the commodity, the name of which disgraced one of the grandest sights of the Empire. The American side of the falls is kept in perfect taste. From Brock's monument at the edge of the Niagara escarpment on the Canadian side, Prof. Davis explained the geographical history of the district.

The whole of Saturday, September 17, was spent in Chicago, where the scientific meeting, at which a few short papers were read to a singularly appreciative audience, was arranged by Miss Zonia Baber, the secretary of the Chicago Geographic Society. The authorities of the University received the Congress, and President W. R. Harper gave a brief address of welcome, which was responded to by Commander Peary.

The buildings of the university were visited, and the various departments inspected. A drive through the large parks and a visit to the Field Columbian Museum filled up the time before dinner. Afterwards such of the members as were not too much fatigued with the heat and hurry of the day, or baffled in the endeavour to find the building by ignoring the guides provided, took part in a reception by the Chicago Historical Society in their interesting fire-proof hall, where there is no wood, the very chairs and picture-frames being all of metal.

Next day was spent in travelling to St. Louis, where the Congress partially merged itself in the International Congress of Arts and Sciences, both being held in the noise and glare of the largest International Exposition which ever was held or probably ever will be. The great defect of this great Exposition was its size, and the absence of any guide-book to indicate the objects of special geographical or general scientific interest was much felt. The multitude of interests represented in the daily programme of the Exposition fairly swamped the Geographical Congress, while the inadequate accommodation, and imperfect organization for the many separate meetings of this and the Congress of Arts and Sciences made attendance on them neither easy nor satisfactory. At the meeting of the Geographical Section of the latter Congress neither chairman nor secretary nor any representative of the committee of arrangements appeared, and but for the presence of Prof. Israel C. Russell and Prof. Chamberlain, who voluntarily assumed these duties, the meeting, which was attended by about thirty persons, could not have taken place.

There was a general session of the Geographical Congress on Tuesday, the 20th, meetings of the section on Anthropogeography on the 21st and 22nd, and of the historical section on the 22nd, the programme of each of which contained a considerable number of papers.

Commander Peary gave a reception one evening on the deck of

the "Arctic Ship Discoverer," a showman's copy of the *Windward* in the ice, and he delivered a popular lecture in the Festival Hall, the great central building of the Exposition, on the evening of Thursday, September 22, at the close of which the Eighth International Geographical Congress was finally adjourned.

So far as the Exposition itself was concerned, there was general unanimity in the opinion that the greatest interest geographically attached to the Philippine exhibit. This included a gigantic map of the Philippine Islands represented on the true curvature corresponding to the scale, and surrounded by a raised platform which made it possible to study every part of it in detail. In addition to exhibits of the typical products of the islands, there were groups of natives of various aboriginal tribes, dwelling in villages which were admirably arranged, and carrying on their usual pursuits.

After the week's immersion in the cosmopolitan chaos of the Exposition, the substantial comfort, rest, and quiet of a special Pullman train on the splendidly equipped Atchison, Topeka, and Santa Fé railway afforded most welcome relief to a large party who undertook a tour to the Grand Canyon of the Colorado river in Arizona, and onward into Mexico, where they became guests of President Diaz. The earlier portion of the trip was an unclouded success, though later a heavy rainstorm and "washouts" on the line caused delay and discomfort. Visits were paid to several settlements of the Pueblo Indians and to the natural wonders of the Grand Canyon and the Petrified Forest, both of them unique each in its own way. The impressiveness of the Canyon transcends that of Niagara itself. The train, after running for hundreds of miles over the waterless plains of New Mexico and Arizona, rising gradually to 7000 feet above sea-level with hardly a hill to be seen, stops suddenly on the edge of a chasm 5000 feet in vertical depth and more than 10 miles across, its sides carved into intricate systems of pillars and buttresses of the most brilliantly contrasted colours, while on the plateau, rather more than halfway down the luxuriant green bordering a tributary stream seems to be rich grass, until the descent of the Bright Angel Trail reveals it in its true character of a grove of tall willows.

Throughout this trip the presence of Prof. Davis, Prof. R. T. Hill, and Prof. Penck ensured that no feature of the geography was passed by without its full bearings being explained; while the infinite incidents of the journey, with many changes of time-table and minor modifications of route, were watched over by Dr. MacCormick, as secretary of the Congress, and Dr. Day, who took charge of the transportation arrangements.

The general impressions left upon the mind by the whole visit to America is, that the Congress attracted less public notice and drew far smaller audiences than in London or Berlin, but that the people who

did attend were keener in their interest and more whole-hearted in their devotion to the study of geography than corresponding audiences in the old world. The hospitality of the four geographical societies which took a share in entertaining the Congress—those of Washington, Philadelphia, New York, and Chicago, to enumerate them in the order of the priority of their opportunities—was absolutely unbounded, and the expense incurred by them must have been great. Although a few names have been mentioned in the course of this report, it has been impossible to refer to more than a small fraction of the number who cut short their holidays and ungrudgingly gave up their time to the entertainment and guidance of fellow-geographers from other countries. To the officers of all these societies the thanks of all the delegates were specially due, and although the circumstances of the conclusion of the Congress were not favourable for an adequate expression of thanks in detail, the American hosts commanded the gratitude of the geographers of all countries.

RESOLUTIONS ADOPTED BY THE EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS, SEPTEMBER 13, 1904.

The following resolutions have been forwarded officially:—

Rules for Geographic Names.

Local names are as far as possible to be preserved, not only in those regions where already established, but also in wild regions. They should on this account be determined with all the accuracy possible.

Where local names do not exist or cannot be discovered, the names applied by the first discoverer should be used until further investigation. The arbitrary altering of historical, long-existent names, well known not only in common use, but also in science, is to be regarded as extremely unadvisable, and every means should be employed to resist such alterations. Inappropriate and fantastical names are to be replaced, as far as possible, by local and more appropriate names.

The above rules are not to be rigorously construed, yet they should be followed to a greater extent than heretofore by travellers and in scientific works. Their publication in periodicals as the opinion of Congress will probably prove of great weight. Although in recent years many official systems of determination of geographic names have been enunciated, we have still evidence of the very slight influence which the wishes of the International Geographic Congresses exert over the decision of the official authorities. To this geographical societies are urged to give wide publicity.

Introduction of the Fractional Scales of Maps.

The Seventh International Geographic Congress expressed the urgent wish that upon all charts, including those published by those lands still employing the English and Russian systems of measurement, along with the scale of geographic co-ordinance, that the scale of reduction should be expressed in the usual fractional form, $1 : x$, and that the latter be added to all lists of charts covering land and sea, and requests the executive committee of the Congress to bring this decision to the attention of all governments, geographical societies, and establishments engaged in the publication of charts.

The advantage to be derived from the support of this resolution, which has its origin with the editor of *Petermanns Mittheilungen*, and the extensive dissemination of the resolution, is at once evident. In English publications a custom has arisen of adding a statement of the ratio $1:x$ to the usually employed x miles to one inch. In America the custom has arisen of going even a step beyond this, namely, the addition of the ratio of reduction has led to the direct application of the decimal system in the units of measure adopted upon the charts.

To this geographical societies are urged to give wide publicity.

The Decimal System.

The Seventh National Geographic Congress expresses itself in favour of a uniform system in all geographical researches and discussions, and it recommends for this purpose the employment of the metric system of weights and measures, as also the employment of the Centigrade thermometric scale.

It is, moreover, highly desirable that there should always be added to statements of the Fahrenheit and the Reaumur scales their equivalent upon the scale of Celsius.

Similar is this question of the metric system, which reaches even more deeply than the former into the well-established customs of daily life, and has proved not without value in promoting international uniformity and simplicity. Although the metric system of weights and measures has made slow progress, and this alone through the portals of scientific work, its application to geophysics and geography has already made a fair beginning. In England a special organization entitled the Decimal Association has taken charge of the matter. The Commonwealth of Australia has entrusted the subject to a commission. We are without knowledge of the efforts in this direction thus far made in Russia.

To this geographical societies are urged to give wide publicity.

Standard Time.

Resolved, in view of the fact that a large majority of the nations of the world have already adopted systems of standard time based upon the meridian of Greenwich as prime meridian, that this Congress is in favour of the universal adoption of the meridian of Greenwich as the basis of all systems of standard time.

Publication of Photographs.

It is suggested, by the lantern slides shown by Mr. Siebers and by the photographs by Mr. Willis, that it is desirable that in these and the cases of other exploring travellers photographs of geographical significance might be published, and accompanied by short explanatory notes, so that they may form collections of representative physical features of different parts of the world.

MR. R. L. REID'S JOURNEYS IN PORTUGUESE EAST AFRICA.*

THE following notes are taken from the account of two exploring trips in the region north of the Pungwe river, Portuguese East Africa, sent to us by Mr. R. L. Reid, who has twice traversed the district for the purposes of sport, in 1900 and 1902, making a rough survey of the country with the prismatic compass. The accompanying sketch-map shows the results of his survey, which adds a considerable amount of

* Map, p. 120.

detail to the best maps hitherto available, which have been based mainly on that compiled by Mr. Ravenstein and published in the *Journal* for January, 1895, on which the routes of Andrada and other Portuguese explorers of this district were laid down. Having with him no instruments for accurate determination of positions, Mr. Reid has been obliged to take these earlier maps as the basis for his own, filling in the details, however, from observations on the march or in camp.

On the second and more important trip (August to December, 1902), Mr. Reid started north from Musasa le Baron, a station of the Gorongoza Company, situated at the lower end of the flat island of Manangora, which lies between the Pungwe river and its branch, the Dingi-Dingi (the latter the larger stream, and the one always used to travel by). Crossing the Dingi-Dingi by a ford east of Mapanda's village, he reached, at the junction of this river with the Urema, the site of the old Portuguese station, known as Laforte, and continued north across the flats of the Urema valley, crossing a number of small rivers which descend from the Nyamonga range, and flow west towards the Urema. Makaia, shown on existing maps as an important place, is really represented only by one hut presided over by a Portuguese trader, half a mile from Bomba, the village of the chief Mwanambu Mtonia. Beyond this the paths near the Urema are only used during the dry months, the best path, passable at all seasons, striking off to the north-east. Following this, Mr. Reid found that the matted grass of the Urema flats gave place to a finer kind, with bush and forest, though the streams were still marked by great flats ("tando") dotted over with baobabs. Where crossed, some of these streams were running strongly with clear water, but most, if not all, lose themselves in sand before reaching the Urema, to which paths, used by fishing parties, lead across the tando from the villages. It is here known as Kombedzi, and further north as the Mukwa. Beyond Mapakuti the country rose rapidly, and was intersected by high ridges sparsely forested. Some of the streams crossed contained numbers of fossil shells in their beds. Majamba, the headquarters of the Portuguese delegate for Sheringoma, was passed, and the highest point reached at the village of the chief Nyabava, the centre of a grain district. Beyond this the country falls again, the forest giving place to thickets and grass, with Borassus palms. Before reaching the site of the old Portuguese fort at Gudo, the country became poor and sparsely inhabited. No rain had fallen for months, water was scarce and bad, while no food was to be obtained for the men. At Sabuko, whence a fine view was obtained across the Zambezi to Mount Morambala, it was necessary to turn back, the country nearer to the Mukwa being explored during the homeward march. The river, known also as the Zangwi, here showed plain signs of running towards the Zambezi, though the natives say that during a high flood in the latter the direction is reversed. The water is here very salt and bad to drink.

Further south there is no well-defined channel for a considerable distance, and abreast of Nyabava's the tando was quite flat and waterless for miles, though there are places where, in heavy floods, the water must spread over a width of 10 to 15 miles. The exact spot where the turn of the water takes place is thus difficult to define. After passing Nyabava's once more, Mr. Reid took the lower road over the flats, finding game fairly abundant, and got back to Bomba on November 3.

From Bomba, Mr. Reid made some trips over the low-lying deltaic tract between the Urema and Dingi-Dingi, which is passable only at the driest time of the year. The Zangwi, which runs across it, is more a succession of swamps than a river, but always contains water in a more or less well-defined channel. The flats on this side are pretty thickly inhabited by an agricultural population, and the wine palm is abundant, groves of it extending to the edge of the Sungwe plains. The view across the tando on emerging from the timber is rendered striking by the effects of mirage. A route for the hill country of Gorongoza was taken along the edge of the palm forest. The Muzikazi was crossed (its water being salt and bad), and a camp formed near the foot of the mountains at Mombezi. Basalt was seen here both in the high ground and in the plain. Going north, Mr. Reid crossed many streams running with clear cold water, and reached the Vanduzi (the upper course of the Sungwe), a fine stream with water pouring over huge boulders. It may be considered the real head stream of the Urema. The soil along the banks seems very rich, and the country is thickly settled, though here, as elsewhere, the people were suffering from the prolonged drought. This soon afterwards broke up, and Mr. Reid decided to return to the coast, making his way with some difficulty down the Urema, which was blocked with a kind of sudd 18 inches thick in places. The Pungwe was very low, and the influence of the tide was distinctly felt as far up as the junction with the Dingi-Dingi.

HYDROGRAPHY OF THE ANDES.*

By Dr. J. W. EVANS.

An examination of the configuration of the Andean region will show at once that it is closely related to the direction of the prevailing winds and consequent distribution of the rainfall. The watershed appears almost invariably to take a line removed as much as possible from the direction from which the winds blow that bring the moisture to the mountains.

In the extreme north, in the region of the north-east trades, the rivers flow north-north-eastward parallel to the Pacific coast from as far south as lat. 2° N. to the Caribbean sea.

In Southern Colombia and Ecuador, where winds laden with moisture reach the

* Research Department, 1904.

THE RIVER SYSTEM OF THE ANDES.

(Northern Portion).

To illustrate the paper by Dr. J. W. Evans.

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mountains both from the east and west, the watershed runs irregularly through the centre of the mountain area; while in the long stretch from the north of Peru to about 33° S., throughout which south-eastern winds prevail, the hydrographic divide that limits the Pacific drainage keeps well on the western side of the great Andean plateaus, and the drainage of the mountain region to the east either flows into the Atlantic or never reaches the sea. Further to the south north-westerly winds replace those from the opposite direction, and the watershed shifts to the eastward. From lat. 41° to the southern extremity of the continent it follows the eastern foothills of the Andes.*

In the region of east winds most of the rivers that drain the Andes traverse the loftiest ranges in deep gorges from west to east; while in the latitudes where west winds prevail, the main chain is repeatedly passed in the opposite direction by rivers on their way to the Pacific.

The relation which I have shown to exist between the winds, rainfall, and rivers of the Andes furnishes evidence that through the long ages during which the present hydrographical system has been worked out, the direction of the winds and distribution of the rainfall have remained essentially the same, though minor variations have no doubt taken place. The exact manner in which these meteorological conditions have influenced the rivers remains to be considered.

The most obvious explanation is that the courses of the rivers have been "cut back" by the operation of rain and other subaërial denuding agents, but my own observations in the Andes have led me to believe that this process is too slow among hard rocks to account completely for the present configuration of the river system, though no doubt it has had its share in bringing it about.

In my recent paper on Caupolican I have given reasons for believing that in Bolivia and the south of Peru the true explanation lies in the fact that the rivers that traverse the great mountain ranges from the lee (western) to the windward (eastern) side are older than those ranges, and have been able, with the help of an abundant rain-supply, to wear down their channels as the mountains rose across their paths, while the streams that flowed in the opposite direction were liable to have their courses barred by earth-movements across their line of flow during a period of rainlessness caused by the rise of mountains to the windward.

I am persuaded that similar reasoning will suffice to explain the hydrography of the Andes throughout their length.†

In Patagonia the gorges through the Andes are not the work of the streams which now occupy them, and which date only from the last and still incomplete emergence of the southern portion of the continent from the sea. They were excavated by older and longer rivers that, before the Andes were raised, flowed from a region of ancient rocks in Eastern Patagonia,‡ now almost completely hidden under the detritus laid down in periods of submergence in Secondary and

* Except for a short distance, where it withdraws to the central line of the Cordillera.

† The inland systems of drainage of the central and eastern Andes between lat. 14° S. and 35° S. are due to the fact that the supply of moisture carried by the south-east winds that pass over the comparatively cool Argentine pampas is less than that brought by the similar winds that blow over the warm, well-watered Amazonian region further north, which must yield almost as much moisture as an inland sea. Even in oceanic regions the trade winds contain less moisture the greater the distance from the equator. The whole of the area included in these inland systems appears at one time or another to have drained into the Atlantic.

‡ See Dr. F. P. Moreno, "Explorations in Patagonia," *Geographical Journal*, vol. 14, p. 367.

THE RIVER SYSTEM OF THE ANDES.
(Southern Portion).
To illustrate the paper by Dr. J. W. Evans.

Tertiary times.* These rivers continued, with the help of the rainfall brought by the western winds, to keep open their channels while the earth-foldings occurred which formed the present Cordillera.

The accumulations during periods of depression of marine deposits derived from the denudation of the mountain slopes or the eruption of volcanoes has sometimes shifted the watershed in the intervening epochs of elevation westward to the gorges,† but with the help of the rains from the north-west the Pacific streams at once commenced to cut their way back to the eastward through the unconsolidated material that filled the old channels; and in many places the process is still going on.

The history of the rivers of the region has been complicated by subsequent earth-movements that have raised new subsidiary elevations to the east of the main axis and depressed the intervening valleys, and, during the last submergence, by arctic conditions, that clothed the mountain slopes that remained above the sea-level with enormous glaciers, which penetrated at their base far down below the surface of the ocean, and, when the land was raised and the climate became milder, left the deep lake-basins that fringe the eastern margin of the Cordillera.

In the extreme south there are fiords, such as Otway water and the western part of the Straits of Magellan, which are ancient river valleys still submerged in the sea. These too were, I believe, carved out by ancient streams that flowed into the Pacific before the Andes rose across their paths.

It is not only in the Andes that we find evidence of similar relations between the winds and rivers; there are many other parts of the world where considerations such as those I have suggested will throw light on the present hydrography and assist us in reading the history of the past. The long period during which the meteorological conditions in the Andean region have remained comparatively unchanged, and the north and south extension of the mountains, render it a peculiarly favourable area for recognizing the effects of the prevalent winds in different latitudes on the river system.‡

Sir Thomas Holdich: Whilst I agree with the general deductions which Dr. Evans has drawn from the conformation of the Andes, viz. that the watershed appears to shift gradually away from the direction in which the wind blows, I think that there are certain very important exceptions to the rule, particularly in the southern part of the Andes. I am not acquainted with the northern section, but as regards the Patagonian Andes, I have had the opportunity of looking pretty closely into their structure, and I found that the watershed there zigzags backwards and forwards, not by any means always along the eastern foot of the hills, but sometimes approaching so closely to the Pacific shore that it had to be condemned as a possible

* These rivers appear to have followed the still older transverse and longitudinal valleys of the ancient axis of elevation which stretched from north-west to south-east. See Dr. Hans Steffen, "The Patagonian Cordillera and its Main Rivers between 41° and 48° South Latitude," *Geographical Journal*, vol. **16**, p. 38.

† The great river valleys of the pampas have been excavated in the course of successive elevations, at times when the watershed retained its western position. They probably followed, in the first place, the line of the valleys of the ancient westward-flowing rivers covered by deep accumulations of sediment, but still represented by depressions.

‡ The inset map illustrating the rainfall of the Andes can only be regarded as diagrammatic, as materials for an accurate representation of the rainfall are wanting throughout the greater part of the area.

boundary, because it gave insufficient hold on the Pacific coast to Chile. The principal exception is at a point not marked on the map exhibited. Lakes Viedma and Argentina both have an Atlantic outlet; and the watershed of the continent, the main divide, is situated so far to the west of them as almost to overlook the sea. As the two lakes occupy considerable space, this is a big exception to the rule; but still I think, on the whole, that rule holds good. Dr. Evans mentioned something about Lake Buenos Aires. Lake Buenos Aires is a very remarkable hydrographical feature, and I am not quite sure that I know of any other like it elsewhere. A very curious feature occurs with regard to the source. Lake Buenos Aires draws most of its waters from northern glaciers by means of a biggish river called the Fenix. For about 30 miles that river holds its own as an important stream, until it divides into two channels, one flowing to the lake, and through the lake to the Pacific, and the other to the Atlantic. What are we to call such a feature as that? The river itself becomes the actual water-divide of the country, so far as I can see, rather upsetting the usual theories of a *divortium aquarium*. There was another point about Dr. Evans's address with which I hardly agree. He says, "In Patagonia the gorges through the Andes are not the work of the streams which now occupy them, and which date only from the last and still incomplete emergence of the southern portion of the continent from the sea. They were excavated by older and longer rivers that, before the Andes were raised, flowed from a region of ancient rocks in Eastern Patagonia, now almost completely hidden under the detritus laid down in periods of submergence in Secondary and Tertiary times. These rivers continued, with the help of the rainfall brought by the western winds, to keep open their channels while the earth-foldings occurred which formed the present Cordillera." I have often discussed that question with the well-known Argentine scientist, Dr. Moreno, and Dr. Moreno was of opinion that there was no evidence of antecedent drainage. That is to say, the lines the rivers have taken have not existed from all times, but their extraordinarily irregular course has been determined by the lines of weakest resistance, probably due to volcanic action. Nor can I agree that the general conformation of the Andes has remained the same for so very long. It is certain that very great changes in altitude have taken place in different parts of the Andes lately. Some parts are still rising, some falling. There is no general elevation; there is no general depression. In one place you will find forests submerged under the sea, and not far away you will find modern shells on the cliff edge hundreds of feet above your head. I might also remark that with these constant changes in the elevation that have taken place, the lake region of South America has changed its outlet constantly, sometimes on the one side and sometimes on the other. I think Dr. Evans is right in saying that the majority of the lakes have now a westward outlet into the Pacific; but a great many still have outlets to the Atlantic, and in almost every case in which we observed the present conformation of those lakes, we found distinct evidence of a former exit to the Atlantic.

Mr. R. D. Oldham desired to express his admiration of Dr. Evans's very interesting paper. In it the good old idea of antecedent drainage had been accepted whole-heartedly—an idea which was both popular and venerable, and consequently to be treated with respect. It had been fully established in certain cases, such as the channels of the Himalayan rivers through the sub-Himalayan ranges, and of the Lune valley in England, but he was unaware of any instance where it had been proved that a river had been able to cut down its channel and maintain its course across anything which could be described as a mountain range, while in all the established cases the source of the river was in a higher range than that across which its course had been maintained. The case of the Indus and Brahmaputra

had been referred to, and though he stood committed to the notion that the course of these rivers across the Himalayas was older than those mountains, yet, since the date of the publications in which this view had been accepted, he had seen cause to modify his opinion, and was more and more inclined to accept the alternative explanation of capture, an explanation which certainly seemed the most probable one in the case of the Sutlej. On the western frontier of India many of the gorges which were ordinarily explained by the theory of antecedent drainage seemed to him more probably cases of capture. He did not think that Dr. Evans had made sufficient allowance for the rapidity with which erosion and cutting back of valleys might take place in rising mountains. He had found that the Scind valley, which drains into Kashmir from the north, had extended its valley by 20 miles, and at one place the old valley-level stood over 2000 feet above the present; the whole of this lengthening, as well as the 2000 feet of erosion through hard limestone, having taken place since the last, and least considerable, extension of the glaciers—that is to say, since a date which is certainly not older than the close of the Glacial period. In view of these considerations, he was inclined to think that the close relation between the direction of the prevailing winds and the position of the watershed, which Dr. Evans had described, indicated that the present hydrography of the Andes is more largely dependent on capture than on antecedent drainage.

Dr. Herbertson: We have listened to a most interesting paper, and I think that Dr. Evans's suggestion that rainfall has considerable control over the position of a watershed ought certainly to be applied to other regions than the Andes. As to his theory of the origin of South American rainfall, I should like to enter one or two protests, more particularly about the rainfall in central Chile, which I do not think can be explained by the heating of Argentina. It is a winter rainfall, not a summer one, and is brought by the ordinary westerly storm winds of the southern hemisphere in their most northerly position. I also think that the south-east trade wind is not accountable for most of the rainfall in the Amazon valley, much of which can be explained as due to locally uprising air or monsoonal brought in by a more northerly wind. But those points have nothing to do with the main thesis which has been discussed this afternoon. The chief objection to Dr. Evans's antecedent drainage explanation has been raised both by Sir Thomas Holdich and Mr. Oldham. In the case of the Southern Andes, the drainage from Lake Buenos Aires is very remarkable. The tributaries of the main streams, as Sir Thomas Holdich said, nearly all run the wrong way. You have tributaries running in the opposite way to the main stream. This happens with most of these west-flowing South Andean rivers, and is an indication of a change of the direction of flow in the main valley. There is another point of some importance. I was especially delighted to hear Mr. Oldham renounce the antecedent theory for the Ganges, because I have ventured within the last year or two to express the opinion that it could not explain all the gorges in the Himalayas. If you make a valley-curve, you find, in the case of the Himalayas, and also in the case of the Andes, that you have a curve which becomes almost flat; then as the river passes through the mountains turns very steep, and then is relatively flat again. Now, if the river had cut its way through rising land, the nick in the curve at the end of the upper flatter part where there had been a temporary base would take place along the axis of most rapid elevation. In the Andes that nick seems to occur on the eastern side of the mountain system, and that is what one would expect if the waters of the rivers on the dry side of the mountain had been tapped by the more vigorous rivers on the wet western side. I should also like to ask Dr. Evans if he has any definite evidence of rivers which now flow to the west of the Southern Andes

through old gorges, if the old deposits have been observed in them, and if there are valleys with old deposits which are not occupied by any river flowing to the west at the present time.

Sir Clements Markham: I should like to make a few observations. In the first place, I wish to point out to Dr. Evans that north of the Cerro Pasco knot the great rivers work to the north just as the Atrato and Magdalena work to the north to the Caribbean sea. In the same way, the rivers Huallaga and Marañon work to the north, to what may be called the Amazonian sea. I should like to call attention to one very remarkable feature in the Andes, namely, what is called the Callejon du Huaylas, in which a river close to the Marañon has a course for many miles due north, and then turns the other way into the Pacific. If you look at that map you will see what an extraordinary feature that is. All those rivers—Huallaga, Marañon, Huaylas—appear to be working northward, and not to the eastward. I would also refer to the period when the Andes are supposed to have risen to their present great height, which you place, I think, in the secondary period.

Dr. Evans: They have risen recently as well.

Sir Clements Markham: I should imagine the rise to be very much more recent. If, as we find in the coast deserts, there are fossil animals in enormous quantities which require dense forests to live in, like the gigantic anteater, there cannot possibly have been lofty mountains entirely stopping the rainfall from coming down on the coast. The Andes must have been much lower, rising gradually. It is also evident that at that period, when those creatures existed, there must have been abundant vegetation where there is now a sandy desert. I have always felt very strongly that it was impossible that those enormous ruins could have existed on the coast of Lake Titicaca, if it was at its present height when they were built. The land must have been lower, sufficiently low to allow grain to ripen, for the builders represented a dense population.

Dr. Evans: In reply to our President's question as to the age of the Andes, I can only say that I do not regard the range as of very great antiquity, as the term would be understood in geology, and agree with him that considerable elevation has taken place in comparatively recent times; but it is probable that throughout Tertiary and even later Secondary times the mountains, though not, it may be, as lofty as at present, were sufficiently high to diminish materially the rainfall to the leeward.

At an earlier period, instead of a continuous mountain chain with a general north-and-south direction, there appear to have been several disconnected elevations with a north-west to south-east strike. The north-eastward flow of the Peruvian rivers referred to by the President probably dated from a time when there was a gap between the Peruvian Andes and the mountains in the south of Colombia.

If the general relation of the winds, rainfall, and watershed for which I have been contending is established, the main purpose of my paper is accomplished, though the question of the manner in which that relation has been brought about remains to be considered. I cannot agree with Mr. Oldham in the importance which he attributes to the operation of cutting back. Except where limestones, comparatively unconsolidated materials, or rocks that have been softened by laterization are concerned, the rate at which a river cuts back at its source is, I believe, so slow that it cannot affect the hydrography and orography of a mountain region to any considerable extent, even in the vast periods with which geology deals.

In my opinion, it is by the antecedent character of the river system that we must explain the main features of the hydrography, not only of the Andes, but of the Himalayas and many other great mountain regions. This is a much more

reasonable hypothesis, for it supposes the great mountain gorges to be the work of the waters of considerable streams and the stones they carry along their beds, which are far more efficient excavating agents than the surface flow that forms a river source. In this position I have the powerful support of Prof. Bonney, who is unfortunately unable to be present, but has addressed me a letter on the subject (see below).

The facts adduced by Sir Thomas Holdich are full of interest, but are not, I think, inconsistent with the views I have advocated.

The seemingly erratic course of the transandine rivers of Patagonia points strongly to an antecedent system of drainage, following, like the Thames, alternately dip-and-strike courses roughly at right angles to one another; but in this case the dip and strike are not those of the elevation of the present Andes, but of earlier earth-movements oblique to them.

Mr. Herbertson has referred to the fact that the rainfall in Central Chili occurs mainly in the winter months, and suggests that this is inconsistent with the view that the summer heat of the Argentine plains causes an indraught from the west. The winter rain is due to the increase of the north-west winds in the winter, which is not a local phenomenon, but occurs throughout the south temperate zone. But the wind charts of the south Pacific show that, relatively, the north-west winds are more prevalent in summer and less prevalent in winter off the coast of Chili than at other points in the same latitudes.

With regard to the direction of the rain-bearing winds of the Amazonian plains, I can testify from my own experience that in the portion which falls within the limits of Bolivia by far the greater part of the rain comes from the south-east. In the north of Brazil a different state of things no doubt prevails.

Mr. Herbertson also referred to the valley curve or profile of the western-flowing rivers of Patagonia, and refers to the fact that the steepest part is to the east of the principal range. This is, however, due to the fact that the land is now far below the level at which it stood when the gorges through the mountains were excavated, and the origiual valley bottoms are now either submerged below the sea or covered with *debris* brought down by the rivers.

In conclusion, I may mention that I believe that the present eastern drainage of peninsular India south of lat. 21° N. dates from a period when the normal north-east trade winds blew over it throughout the year, and all the rainfall came from that quarter. The present south-west monsoon is the result of the great extent of land to the northward, much of which was still covered by the sea as late as Eocene times.

Rev. Canon Bonney wrote as follows to Dr. Evans: That when a river cuts through a range the latter is the younger, is a statement to which it would be very difficult to find an exception. I have long been convinced of this, and have stated it in print, in the case of the Alps and Himalayas; also that South America, south of about lat. 41 S., is a partially submerged land like Norway. The relation between the river courses and the meteorology strikes me as important, particularly as bearing on the antiquity of the existing conditions. But, I suppose, allowing for expansion and contraction of the trade-wind belts (and, of course, others relating to them) and for important local interferences owing to geographical changes, the general arrangement of aërial currents on the globe must have been constant from the first.

HYDROGRAPHY OF THE NILE.

Sir William Garstin's Report * on the Basin of the Upper Nile, which supplements, and in part supersedes, his previous Report—Egypt (No. 2), 1901—is perhaps the most sumptuous and attractive Blue Book ever issued from the Foreign Office, and is a highly creditable production of the Egyptian Ministry of Public Works. Invaluable to geographers, it constitutes the standard work on the hydrology of the Nile, whilst the chapter on river-discharges contains fuller information on this subject than has ever before been published. These Reports cover five years' consecutive observations on the Bahr el-Gebel; and although there are no levelled altitudes between the Victoria Nyanza and Khartum (the Upper Nile basin, properly so called, or region of tributaries, all of which are included with the exception of the Atbara, which is not a permanent stream), the barometric and hypsometric observations furnish an approximate determination of the relief of the country. Incidentally, a good deal of geographical information is admirably summarized, the most recent reports having been collated with the observations of the pioneer travellers—particularly with those of Dr. R. W. Felkin, whose work has not previously been adequately recognized. There is, however, the usual inconsistencies in the spelling of place-names; and this is to be regretted, no less than the absence of an index.

In regard to purely geographical questions, it is interesting to note that Sir William Garstin recognizes the river Kagera as the real source-stream of the Nile, if any of the feeders of the Victoria Nyanza be selected as such, but rightly insists that the lake-reservoir itself is the true source. As to whether the shrinkage of the Victoria Nyanza be due to natural causes (as in the Albertine lakes) or to a diminished rainfall, Sir William leaves this as more or less an open question, but hazards the suggestion that, if there be a permanent fall in the lake-level, "it can only be accounted for, either by a general reduction in the annual rainfall, or by a lowering of the bar at the Ripon Falls," although "a careful examination of the last-named site showed no sign of any degradation of this ridge" (p. 28) In fact, the water-action on this hard and compact barrier is very slow, and can in no wise account for the shrinkage of the lake within the last twenty to thirty years. "It is difficult, then," says Sir William Garstin, "not to arrive at the conclusion that this fall is not a permanent one, and will, should another period of heavy rainfall set in, disappear, and the lake rise to its former level" (p. 28). The maximum annual oscillation of the lake is from 1 to 3 feet.

The most interesting section of the Report, to which the reader will naturally turn first, is that dealing with irrigational projects in the basin of the Upper Nile, together with Mr. Dupuis' Report on Lake Tsana and the rivers of the Eastern Sudan. The observations of the pioneer travellers, even when collated by an hydraulic engineer, were, and are, wholly inadequate to throw light on the important question of the relations between the Equatorial lakes and the volume of the Upper Nile; but the systematic observations made since 1900–1901 have materially added to our knowledge of the hydrology of the river.

"The problems to be investigated," says Sir William Garstin, "have two main objects, namely, that of increasing the water-supply of Egypt in the summer, and

* 'Report upon the Basin of the Upper Nile, with proposals for the improvement of that river.' By Sir William Garstin, G.C.M.G., Under-Secretary of State for Public Works in Egypt. With Illustrations, Appendices, and Maps. Cairo: National Printing Department. 1904. [Issued also as a Blue Book: Egypt, No. 2, 1904.]

that of securing similar advantages to the Sudan during the same period. . . . The best way in which to secure the results aimed at would appear to be to reserve the waters of the Blue Nile for the improvement of the countries bordering that river, while Egypt and the area of the Nile lying to the north of Khartum shall derive their summer supply from the sister river" (p. 172). In the two months of low discharge, the Nile reservoirs are the sole sources of supply. "The objection to any proposals for augmenting the discharge from the Equatorial lakes is that, under present conditions, the increased volume would never reach the White Nile, but would be entirely wasted in the marshes through which the Bahr el-Gebel passes . . . Barely 50 per cent. of the water which now leaves the Albert lake in summer ever arrives at the White Nile, while in the flood the proportion of loss is very much greater. . . . Until, then, some means have been found whereby the water passing Lado during the dry season of the year can be brought down to Khartum in undiminished volume, it is needless to consider the question of any regulation of the Albert and the Victoria lakes" (p. 174). Thus it will be seen that it is important to preserve the regulating power of the marshes (Bahr el-Gebel) for the flood water, and at the same time to find some means of preventing the present wastage in the river during the dry season. It is therefore proposed, as an ideal of perfection, to construct an entirely new channel for the Bahr el-Gebel, which, if the levels and the country permit, would improve the river to a much greater extent than merely remodelling one or other of the existing channels. This artificial channel would not be much larger than one of the great canals in Egypt; and it would, if feasible, follow a north-and-south alignment from Bor to the Sobat confluence—a distance of 340 kilometres. Although the Bahr el-Zaraf (650 kilometres) is a better channel than that of the Bahr el-Gebel (710 kilometres) for delivering the summer supply, the direct route would be by far the best, and, in spite of the greater cost, it would be easier and quicker to construct, besides being a boon to navigation (unless the slope be too great) and cheaper to maintain. Moreover, it would be the true complement of the lake-reservoirs scheme.

The best site for a regulator to the Albert lake is at the fifteenth kilometre downstream of the outlet, where high land borders the river-channel on both sides; and the natural site for a regulating work at the outlet of the Victoria lake is, of course, at the Ripon Falls. Apart from remoteness and consequent cost, there would be no difficulty in constructing either of these works, the engineering obstacles being less than at Aswan. It is interesting, too, in this connection to note that Sir William Garstin endorses Sir W. Willcocks' suggestion, that the best plan would be to cut down or lower the crest of the Ripon Falls instead of attempting to raise the lake-surface; but, he adds, this would involve embanking the river (*thalweg*) in its course through Lake Chogo (80 kilometres). On the other hand, the effect of closing the Ripon Falls by a regulator, and thus possibly raising the level of the lake, would be that the supply would be entirely cut off during at least three years, which, it is estimated, would be needful to raise the lake-level by one metre.

The ideal project of constructing a regulator at the outlet of Lake Tsana, whereby this lake would be converted into a storage reservoir of adequate capacity, must be dismissed for political reasons. If this natural reservoir could be used, it would be necessary only to construct a system of weirs in the river-bed of the Blue Nile between Rosaires and Khartum, with canals taking off above them on either side, in order to ensure the water-supply for *Sefi* cultivation in the Ghezira and Eastern provinces. Outside of Abyssinian territory, a site might be found between Famaka and Rosaires for a dam and reservoir of moderate storage capacity, which would supplement the winter-supply in the Blue Nile. During the winter months the

supply of water for Egypt is ample, and the Blue Nile could be safely drawn upon for local needs. The construction of a reservoir, though of limited storage capacity, south of Rosaires, would materially assist in augmenting the winter discharge of the Blue Nile; and a beginning might be made in the irrigation of the northern portion of the Ghezira, particularly to the north of Wad Medani. But the projects of constructing a barrage on the Blue Nile, for controlling the river Gash, and for obtaining additional supplies from the rivers Dinder, Rahad, Settit, and Atbara, have yet to be studied, and a series of levels run, before any definite schemes can be formulated.

In Appendix I. Sir William Garstin enumerates the following works, which deserve special attention:—

(1) The remodelling of the Bahr el-Gebel.
(2) The construction of a barrage in the Blue Nile.
(3) A canal system in the Ghezira in connection with this barrage.
(4) The regulation of the river Gash.
(5) The construction of a storage reservoir somewhere in Sudan territory, south of Rosaires.
(6) The regulation of the Victoria and Albert lakes.

"Of these," he says, "the first and last will be undertaken more in the interests of Egypt than of the Sudan, except as regards the Nile valley north of Khartum. The others are designed for the benefit of the Sudan alone." From Khartum to Berber the conditions are quite different to those on the Blue Nile, and resemble those of Upper Egypt and Dongola. In regard to Egypt, more particularly, none of these schemes are of extreme urgency except the provision of escape power for the Nile during an exceptional flood. Sir William Willcocks' suggestions and proposals in this respect are dealt with in Appendix I. under the following heads: (1) the raising of the Aswan dam; (2) the utilization of the Wadi Rayan depression as a secondary reservoir; and (3) the remodelling of the Rosetta branch of the Nile. The combination of the first two schemes, making the one the complement of the other, is an entirely novel idea, and a striking instance of the high capacity of its author; but space precludes our dealing with these technical matters, as well as with the indeterminable question of cost.

A. S. W.

THE FRENCH CONQUEST OF THE CANARIES IN 1402-6, AND THE AUTHORITY FOR THE SAME.

By C. RAYMOND BEAZLEY, M.A.

The French conquest of the Canaries, at the beginning of the fifteenth century, that first chapter of modern colonial history, has long been considered to rest upon an authority ('Le Canarien') of exceptional value, being not only a contemporary witness, but written by men who were present at, and took part in, the events here recorded with such a wealth of life-like and picturesque detail. And in many respects this view is correct enough. For the *Livre de la Conqueste et Conversion des Canariens . . . en* 1402 . . . *par Jean de Béthencourt . . . composé par Pierre Bontier* (sic), *moyne de S. Jouin de Marnes, el Jehan le Verrier, prestre séculier, chapelains du dix seigneur*, printed by Pierre Bergeron in 1630, collated by d'Avezac with the Mont Ruffet manuscript of c. A.D. 1482 (from which Bergeron seems to have worked, and which Charton used for his 'Voyageurs anciens et modernes' of 1855), is, after all, one form of the original record of this Norman conquest in the Atlantic. It is also, combined with the results of d'Avezac's collation of the

manuscript aforesaid, the form reproduced and translated by Major in 1872 for the Hakluyt Society; in other words, the standard form for English scholars of the last generation. But it is not the most original, nor the most trustworthy form; for the history of the French expedition to the Fortunate islands is here revised to suit the views of the Béthencourt family. It therefore magnifies the figure of Jean de Béthencourt, depreciates the achievements and importance of his colleague, Gadifer de la Sale (or Salle), and combines the original narrative of Pierre Boutier the Benedictine and Jean le Verrier the secular priest, with additions of various kinds, such as the last twenty-five chapters of Major's edition, following upon the description of the Canary islands (Hak. Soc. edition, pp. 140–220). Its representation of many incidents is totally different from that of the primitive Record lately rediscovered, where the writers' sympathies are clearly with Gadifer, and where Jean de Béthencourt is unsparingly criticized—not in reference to his treatment of his wife, as in the later Redaction, but in regard to his conduct in the joint leadership of the Canary conquest. Gadifer de la Salle, through the words of his chaplain and advocate, Pierre Boutier, has once more, after the silence of centuries, made himself heard. The acquisition of the Egerton manuscript No. 2709 by the British Museum in 1888 has produced this result. The manuscript in question, formerly in the possession of the Baroness de Hensch de Langry, is of much earlier date than that from which Bergeron, Charton, d'Avezac, and Major worked; it belongs to the first quarter of the fifteenth century (c. A.D. 1420); it contains a reference to the Papal schism ended in 1429 (fol. 29*b*, "nous auons deux papez," etc.); it is usually composed in the first person plural, and not, like the text of 1482, in the third person; and it unquestionably represents an older (probably the very earliest) form of the conquest narrative. It implicitly contradicts the tradition that Jean le Verrier dictated to Pierre Boutier the record to which these two ecclesiastics jointly set their names. It makes clear that the two ecclesiastics aforesaid were not, as suggested by the later text, both chaplains of Béthencourt, but that Boutier was the spiritual attendant of Gadifer. Finally, as already noticed, it furnishes Gadifer's statement of the whole episode of the Canarian invasion, and supplies a number of detailed accusations of inefficiency, slackness, disingenuousness, fussy assumption of superiority, and the like, against Jean de Béthencourt.

This Egerton manuscript, henceforth its primary authority for the French conquest of the Canaries and the first extension of European influence to the Atlantic islands, before its acquisition by the British Museum, had remained wholly without notice or collation; a short but excellent description of it is given in the 'Catalogue of Additions to B. Mus. MSS.,' 1888–93, and a transcript of it was made by Miss Lucy Toulmin Smith for M. Pierre Margry and printed (unfortunately with many mis-readings) in the latter's 'Conquête . . . des . . . Canaries,' 1896. But no one has yet made an adequate comparison of this text with that given by Major and d'Avezac, although the main features of difference have been already pointed out both by the Museum 'Catalogue of Additions' above quoted by Margry. It may, therefore, be of use, by certain select examples, to warn English students who may touch on, or in any way interest themselves in this fascinating chapter in the History of Exploration, that the old standard text, given to them and translated for them in the Hakluyt Society's publications, can no longer be taken as sufficient. Here and there it adds points not in the Egerton manuscript, but (within the period common to both) it omits far more important matters represented only in the latter. And among these we have first and foremost the matter of the chief credit and honour. In Major's text these are almost wholly due to Béthencourt; in Egerton they are mainly Gadifer's.

To show how important are the modifications now introduced into the received account, it will be enough to compare the more interesting variants of the preface and the first nine chapters.

At the beginning, the 'Livre nomme *le Canarien*' speaks of the present Norman conquest of the Canary isles (*qui se dient les Isles de Canare*) as parallel to the Christian conquests of heathen lands in olden time. Here both texts agree; but whereas in that of Major Béthencourt only is named as leading the enterprise, in Egerton Gadifer is not merely mentioned but placed first. Thus—

MAJOR.	EGERTON.
". . . Jean de Bethencourt, Chevalier, né du Royaume de France eut entreprins ce voyage . . . au soustenement . . . de nostre foy . . . en certaines Isles qui sont sur celle bende, qui se dient les Isles de Canare" [p. 1, Hak. Soc.].	"*Gadifer de la Sale et* Jehan de Bethencourt, *Chevaliers, nez* du Royaume de France, *ont* entre*pris* ce voyage . . . *du soustenement**. . . de nre sainte creance . . . en certaines Isles qui sont sur celle bande, qui se dient les Isles de Canar*ie*." [Preface fol.]

The authors' introduction of themselves to their readers is also very different in the two texts.

Thus Major reads—	While Egerton has—
"Et nous Frere Pierre Bo*n*tier moine de Sainct Jouin de Marnes, et Jean le Verrier, prestre, et seruiteurs du dit de Bethencourt dessus nommé, auons commencé à mettre en escrit le plus des choses qui luy sont aduenues . . . et . . . la maniere de son gouuernement . . . dès ce qui se partit . . . de France iusques au 19 iour d'Auril 1406."	"Et nous Frere Pierre Bo*u*tier moyne de Saint-Jouyn de Marnes et Mons.* Jehan le Verrier, prebstres,* *Chapellains et serviteurs des Chevaliers desus nõmes* avons cõmancié a mettre en escript *toutez* les choses qui *leur* sont advenues . . . et . . . la maniere de *leur* gouvernement . . . des ce qu'ilz *partirent* . . . de France iusques au xix^{e} iour d'Auvril *mil iiij^{c} et iiij* (i.e. *1404*)."

Once more, at the end of the Preface, Egerton adds the following important particulars about Béthencourt, which, however honourable in themselves, were evidently unpalatable, and so deleted in the revised text:—

Et veu que Bettencourt en fait d'armes aet * *perdu la force et la vertu d'aucuns de ses membrez, on li deveroit bien tenir à grant honeur* [with three more lines of double-edged praise, all carefully removed from the text of 1482].

Again, when the narrative proper at last begins—

Major's text "makes mention"—	But Egerton simply speaks—
"de l'entreprise que Bethencourt, Cheualier et Baron, né du Royaume de France en Normandie,* lequel . . . se partit de son hostel de Grainuille la Taincturiere en Caulx, et s'en vint à la Rochelle et là trouua Gadifer [with ten more lines describing how Béthencourt *persuaded Gadifer to join him*, and so made his *accidental* meeting the foundation of his enterprise]."	"de l'emprinse* que *Gadifer de la Sale et* Bethencourt, cheualiers,* *nez* du Royaume de France, *l'un Poytevin du pais de Touarsois,* l'autre Normant du pays de Caux, ont * [after which a lacuna of a few words' space] comẽnce a mettre en escript les choses qui *leur* sõt avenues, des qu'ilz partirent de *leurs* nacions et pensons a poursuir ure escripture iusque a la fin de *leur* conqueste . . ."

* The main verb is wanting in both texts.

Again, when on their way, the French squadron gets into a dispute with the Seigneur de Hely at Corunna, it is in Egerton, not Béthencourt, but Gadifer, who offers the restoration of the boat and anchor, which the Seigneur claimed (' Quand *Gadifer* vit cela, it dist au Sire de Heli,' etc., chap. 1 Eg.). Similarly in Spain, when the Frenchmen are accused of piracy by the merchants of Genoa, England, and Piacenza resident at Seville, it is in Major Béthencourt—in Egerton Gadifer—who lands (" sy descendi *Gadifer* a terre," etc., Eg. chap. 3). In the same way, it is Béthencourt (in Egerton) who weakly proposes—" *ie ne sçay a quelle fin* "—to compromise with the mutinous crews at Seville, Gadifer who dissuades from folly (this incident is entirely wanting in Major's text); it is Gadifer who first lands in Lançarote (" l'isle *Lancelot* "). While as to the submission of the native king and the first fortifications and military arrangements in Lançarote, the two texts again vary with the old significance—

MAJOR.	EGERTON.
" Le Roy du pays viendroit parler à M. de Bethencourt, en la presence de Gadifer . . . et se vint ledit Roy en l'obeissance dudit Bethencourt. . . . Et demouièrent ledit Roy Sarrasin et M. de Bethencourt d'accord, et fit faire le dit Sieur de Bethencourt vn chastel, qui s'appelle Rubicon. Et laissa M. de Bethencourt vne partie de sa compagnie . . . semblant au dit de Bethencourt qu'un . . . Berthin de Berneval," etc. (Major, p. 10).	" Le Roy viendroit en certain lieu et ainsi fu il *car Gadifer, ne vouloit mie faire nul accord à euls sans Bettencourt* . . . et se mistrent à l'amistance *des Chevaliers des susdits. . . . Mais Bettencourt en a depuis mal fait son devoir,* ainsi que vous verrez un pou cy apres Et demourerent *euls et ceuls de l'isle Lancelot* en bon accord. Apres *commencerent* un chastel qui s'appelle *Rubicum.* Et laisserent la une partie et *leurs* gens; et *leur* semblant que Bertin de Berneval," etc. (chap. 4 Eg.).

Once more, in Major, Béthencourt advises with Gadifer for a night expedition against Fuerteventura; in Egerton, it is simply—

" *se parti Gadifer et Remōnet de Leuedan avecquez une partie* . . . (chap. 5 Eg.)

And last among these examples we may notice how in chapter 7 (Eg.) Béthencourt's return to Spain to procure reinforcements and provisions is denounced in the primitive text as a deception—" *mais il en a fait tout le contraire, ainsi qu'il est escript en ce livre, plus a plain;* " how in chapter 8 (Eg.; 24 in Major) Béthencourt is blamed for the loss of the ship (" *par faulte de bon gouvernement et de bonne ordonnāce* "); and how in the latter part of the same chapter, as well as in chapter 9 (Eg.; answering to chapters 25 and 26 in Major), he is accused of taking no proper measures for the relief of Gadifer (" *ni mist onques autre remede, ains demōra sās autre chose en ordenner* "), of neglecting to profit by any warnings of his friends' distress (" *mais il n'en fist compte* "), of taking but a slight part in the venture, of swaggering about at the Court of Castille, of posing as " Lord of the Canaries," and of turning things to his own selfish profit (" *aucunes choses qui sont venus au prouffit de Bettencourt, bien a la value de V. c doubles d'or, selon ce que on dit a Siuile . . . et s'appela la* * *Seigneur des Isles de Canare, combien qu'il y' a pou travaille et mis du sien, especialement en la conqueste, car il n'y a eu que trois de ses gens . . . et impetra du roy* [de Castille] *le quart de toutes les marchandises qui viendroient des isles, sans faire mencion de son compaignon* "). In most of these citations from

* At the court of Castille.

the Egerton text it will be evident, to any one who compares the same with Margry's readings, that the latter are far from giving the manuscript exactly. Thus *soustement* for *soustenement*, *nous* for *Mons.*, *prebstre* for *prebstres*, *avoit* for *aet*, *Gadifer . . . et Bethencourt* for *Gadifer . . . et Bettencourt cheualiers*, *enprinse* for *emprinse*—all starred passages—are instances to the point in the preface and first chapter alone.

REVIEWS.

EUROPE.

Russian Lapland.

'Three Summers among the Birds of Russian Lapland.' By Henry J. Pearson. With History of St. Triphon's Monastery and Appendices. London: R. H. Porter, 1904. Size 9½ × 7½, pp. xvi. and 216. *Maps and Illustrations. Price 20s. net. Presented by the Author.*

This well-printed and profusely illustrated work is the successor to the author's 'Beyond Petsora Eastward,' which was noticed in this Journal for 1900 (vol. 1, p. 189). The district now described is the portion of the Murman coast which lies between the mouth of the Pechenga river (say 70° N. lat.) and Lutni, the latter behind the promontory of Sviatoi-Nos, in lat. 68°. From Lutni, which Mr. Pearson had visited in 1895, he steamed eastward, across the throat of the White sea, to the Kanin peninsula, and found a landing-place somewhere to the southward of Cape Kanin. No inhabitants were met with, but there was a house and also a chapel, and the place is conjectured to be on the river which is named Bogrametza in Imray's chart of 1895. In general character the valley resembled Kolguev island, previously visited, and one of the photographs gives an idea of the thousands of tons of driftwood to be seen on the shore. Attempts were made to find a landing-place further south, but in vain, owing to fog and surf, so a return was made to Lutni. On all three occasions the summers were cold and backward, the worst being in 1899, when the valley of the Pechenga was ascended and the monastery of Saint Triphon visited. Of this establishment and the beneficial influence exercised on the peasants by the monks, Mr. Pearson speaks in high terms. On the third expedition the gulf and river of Kola were ascended to Lake Imandra; it was not necessary to cross the peninsula and come out at the Gulf of Kandalax, because that district had recently been explored, from the ornithological point of view. For bird-nesting was the main object of these trips, but the narrative affords very good reading; while an Appendix, in which lists are given of the requisite stores and clothes, cannot fail to be useful to future travellers. The map is adapted from one published more than a quarter of a century ago by Prof. J. A. Friis.

H. S.

Germany in the Middle Ages.

'Historische Geographie Deutschlands in Mittelalter.' Von Dr. Bodo Knüll. Breslau: 1903.

The inspiration of the present work has been Wimmer's 'Historische Landschaftskunde' (Innsbruck: 1885), and a very fortunate inspiration it has been. Admirably clear in statement, and careful in research, Dr. Knüll's essay deserves to be expanded into a treatise of much greater length. The author begins with a study of the changes in Central European natural features,

directing attention especially to the Baltic and North sea coasts, the rivers, and the lakes. He next examines the changes in the human element ("Der Weschsel der Bewohner") during four great historical periods—before and during the *Völkerwanderung*, from the *Völkerwanderung* down to the close of the Karling Age, and from the accession of the Saxon Dynasty to the close of the Middle Ages. Thirdly, the settlement of the various German districts—including the Swiss and Austrian German lands—is reviewed with great care, under the periods roughly corresponding to those already indicated ("bis zur Volkerwanderung," "von der Zeit der Volkerwanderung bis auf Karl den Grossen," "seit der Zeit Karl des Grossen"), and with special reference to (1) the North-West Lowlands, (2) the Central Highlands and the Alps, (3) the Eastern semi-Slavonic regions. Considerable attention is also devoted to the variations in animal and plant life in the Germany of the Middle Ages; to the mediæval discovery and exploitation of mineral deposits, and especially of gold, silver, iron, and coal; to the Keltic, Roman, Slavonic, and German methods of colonization and cultivation; to the gradual civilization of the settled territory by towns and townships, by monasteries, by roads and bridges, by markets and commerce; to the various types of architecture, religious, military, feudal, and domestic. While, in conclusion, an historical summary of German progress from the first century before Christ to the end of the Middle Ages, enables the author to gather up in a few pages the chief lessons of his work. The evidences of the survival of Roman civilization in certain districts, the indications of progress afforded by local municipal history, the civilizing work of the great monasteries, the history of the leading trade-routes and trade-centres—none of these are neglected, and the result is a valuable introduction to the history of Germanic civilization; in distinction from Germanic wars and dynastic annals, during the time of the making of our modern world. C. R. B.

Survey Atlas of England and Wales.

'The Survey Atlas of England and Wales.' A series of eighty-four plates of Maps, and plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Edinburgh: John Bartholomew & Co. 1903. *Price* £2·12*s*. 6*d*.

The Survey Atlas of England and Wales is now completed, and Mr. Bartholomew may be congratulated upon bringing to a most successful termination the task upon which he has been engaged for over ten years. He has produced an atlas of which he may well be proud, and with which our Society, under whose patronage it has been published, has no reason to regret that it has been associated.

The task has been of great magnitude, and one which has never been seriously attempted before, involving nothing less than a complete series of maps of the whole country, on the scale of 2 miles to an inch, reduced from the Ordnance Survey, Admiralty Charts, and other sources. This alone has been a colossal undertaking; but in addition, the early part of the atlas consists of an excellent set of physical and statistical maps and tables prepared from the latest reports and Government returns, the results of which are now for the first time presented in a graphic form.

The atlas has been published in monthly parts, the first of which appeared early in 1903; but years before this the preparation of the maps was taken in hand, and the 2-miles-to-an-inch sheets, with their orographical tinting, had been issued separately, and had established for themselves an excellent reputation, especially

amongst tourists and cyclists. These sheets, which form the principal part of the atlas, have been carefully reduced from the Ordnance Survey, by special permission, and before publication in the atlas, have been submitted to local authorities and others for revision and correction, to bring them as far as possible up to date. They are altogether sixty-seven in number, and cover the whole country. Each one includes an area of about 1270 square miles, and measures 15½ inches by 20½ inches. The nomenclature has received particular attention, and the selection of the names from the Ordnance Survey sheets has been made with evident discretion and care. It would be too much to expect that a work of such magnitude should be altogether free from errors, but these are few and far between.

The special feature of these maps is their orographical tinting, by means of which a general idea of the elevation of the land in any part can be obtained at a glance. The selection of the tints has been a matter of great consideration. The tints finally chosen are altogether eighteen in number. First there are four shades of green at intervals of 100 feet, then follow tints of burnt sienna and brown up to 2750 feet, increasing in density with the altitude. The first four of these are at 200 feet, and the remainder at 250 feet intervals. Finally there are, for those few areas where the altitude exceeds 2750 feet, two shades of purple, which hardly appear in character with the rest of the shading. For the purpose in view, the tints of brown leave little to be desired, and they blend well with each other; but the transition from the shades of green for the lower districts to those of brown is necessarily abrupt, and it would have been better if it could have been managed to have had shades of one colour throughout, though this in actual practice may be difficult.

Among the smaller-scale general maps in the first part of the atlas, there are some that are worthy of special attention, such as the Bathy-Orographical Map of England and Wales with the new physical nomenclature as approved by the Council of the Royal Geographical Society; the Geological Map, with an inset showing the distribution of coal and iron, and another of the geology of the environs of London; maps showing density of population; an extremely useful little series of meteorological maps; commercial and industrial maps, and several others.

The atlas opens with several pages of letterpress of a general and statistical nature, commencing with a description of "The Physical Features of England and Wales in Relation to Political and Commercial Development," by Dr. H. R. Mill. Then follow a brief account of the geological features by Sir Archibald Geikie, tables of mean monthly and annual temperatures of one hundred and ten stations of England and Wales by Dr. A. Buchan, tables of rainfall, agricultural, population, ecclesiastical, parliamentary, railway, commercial, and other statistics. These are followed by a most useful table giving the etymology of English and Welsh names, and finally a list of maps of England and Wales from the earliest times, in chronological order. Although it is not pretended that this list is complete, yet it is fairly full, and will be useful for reference.

Instead of an index, Mr. Bartholomew has published simultaneously a Survey Gazetteer of England and Wales, which serves all the purposes of an index, and gives a good deal more information than could be included in an index.

In conclusion, it must be admitted that by the publication of his 'Survey Atlas of England and Wales,' Mr. Bartholomew has rendered a great public service, and has done much, with previous similar work, to raise the standard of British cartography. The atlas will be of the greatest utility for many purposes.

E. A. R.

ASIA.

Tibet.

'Il Tibet (Geografia, Storia, Religione, Costumi) secondo la Relazione del viaggio del P. Ippolito Desideri (1715-1721).' By Carlo Puini. Rome: 1904. lxiv. + 402 pp.

As stated in Sir C. Markham's 'Narrative of the Mission of George Bogle to Tibet,' etc., the long-forgotten MS. of the Jesuit Father Desideri's 'Ragguaglio' was rediscovered at Pistoia in 1875 by the distinguished orientalist, Prof. Carlo Puini, who at once proposed to publish the valuable document, with all necessary notes and illustrations. But the owner, Cavaliere Rossi-Cassigoli, refused his consent, preferring to yield all rights "for a consideration" to the Hakluyt Society, which had offered to bring out an English edition. This project, however, also fell through, owing apparently to the death of the owner, and no further action was taken till the year 1901, when the proffered aid of the Italian Geographical Society enabled Puini to carry out his original design in a modified form. What he has now issued is by no means a complete edition of the 'Ragguaglio,' which contains a comprehensive account of the author's travels and missionary work in Persia, Kashmir, the Moghul empire, Little and Great Tibet, and the capital Lhasa, where he resided for six years (1715 to 1721), that is, far longer than any other European before or since his time. Puini's work is entirely confined to the Tibetan section, which forms little more than half, though certainly by far the most valuable half, of the MS. Even this section is not given in full, but edited on a sort of eclectic system, which perhaps need not be regretted, seeing that it abounds in needless repetitions, is written in a somewhat prolix and inflated style, and put together in a confused way without any chapter or other sectional divisions except quite towards the end. These are now supplied by the editor, who also gives a brief notice of Desideri's predecessors and immediate successors in Lhasa, a summary of his travels in the East, five of his letters written during his stay in Tibet, a geographical survey of that region, and an appendix containing a history of political events brought down to the eve of the recent British expedition to Lhasa. There are indexes of Tibetan and Sanskrit words, with a scheme of Tibetan transliteration, and a general subject-index.

The text itself, or such portions of it as are here produced, the editor has supplemented, not only with numerous explanatory notes, but also with lengthy intercalated comments, which, coming from such a high authority on Tibetan subjects, have a distinct value of their own. Unfortunately, they are at times introduced in such a way that it is not always easy to distinguish between Desideri's language and Puini's comments. The difficulty, however, will scarcely be felt by those able to appreciate the difference between the literary tone of present and early eighteenth-century Italian, even though the orthography has been made conformable to present usage. This conformity was doubtless necessitated by the fact that the MS. is evidently in three different contemporary hands, one of which appears to be that of a somewhat ignorant scribe writing from dictation.

But if the document may seem to be somewhat over-edited, the student will still be grateful to Prof. Puini for his careful treatment of the parts dealing with Tibetan Buddhism and Lamaism, to which over a third of the volume is devoted. The geography and history of the country, the usages, social and political institutions of the people, are now fairly well understood. But much light is still needed for the elucidation of their strange religious systems—the primitive Shamanism, the later Bonboism, the historic Buddhism and Lamaism—all superimposed one on the other, and arresting the normal progress of the nation for ages. Such light

can be looked for only from those rare scholars who, like Csoma de Körös, Rockhill, Desideri, and Puini, possess a thorough knowledge of the difficult Tibetan language and its voluminous Buddhist writings. Hence, pending a complete edition of Desideri, Puini has made a valuable contribution to the study of Tibetan and other primitive religions by the numerous critical remarks with which he has accompanied his copious extracts from the 'Ragguaglio.'

A. H. KEANE.

'Tibet.' By Dr. Georg Wegener. Halle: 1904. Pp. 147. *With Maps.*

Dr. Wegener puts forward an excellent handbook to Tibet, embodying the most familiar results of the recent development of acquaintance with that country. He deals first with the history of the name, the boundaries and extent of the country, and the slow and interesting growth of knowledge concerning it. Its physical features, climate and inhabitants, trade-routes and trade, are then treated; finally, chapters are devoted to Lhasa, to political history, and to relations with England. A comprehensive list of authorities to which reference has been made completes the work. Sheet 62 of the new Stieler Atlas (Inner Asia) is included in the book, and there are uncoloured plans of the route taken by the English expedition of Lhasa, and of the relationship of the country with the main waterways of Southern Asia. The illustrations are such as have recently appeared in the illustrated press of this country; in fact, to that medium the dissemination of such knowledge as that to which this book is an introduction, is mainly left in England. It is, however, within the scope of a monograph of this sort to improve upon the better class of newspaper article, by giving a scientific arrangement and such additional facts as a list of authorities, and it is to be hoped that in the future the necessity to supply a demand for such short treatises will arise in this country. The present short work would serve as an excellent model. It is well arranged and well printed, lacking only an index or detailed synopsis.

ASIATIC TURKEY.

'Dar-ul-Islam.' By Mark Sykes. Bickers. 1904. Pp. xxiii., 294. *With Maps.*

Into a curious and not wholly pleasing medley of humour, anecdote, moral and political reflection, and description of travel, Captain Sykes incorporated a certain amount of valuable geographical matter. He ranges from Damascus to Tiflis, and from Constantinople to the Tigris. Mainly in the districts north of Aleppo, he provides certain sectional route-maps, showing his road, with rough hill-shading and elevations, salient buildings, and other features. They are designated as sketches not absolutely accurate, and are not on a uniform scale or in a uniform style, but they are clear, and, taken together with his excellent photographs, instructive. Illuminating descriptions of some of the places visited are given, and into some of the jocose native character-studies it is possible to read an ethnological interest. The book would be worth the attention of casual travellers in Captain Sykes' tracks, and it may be noted further, that he indicates several sites which are apparently awaiting the researches of archæologists. One section at least of Captain Sykes' journey was probably more remarkable than his narrative makes it appear, for he travelled in the Taurus for a month in winter, and the slight indications of the difficult and even dangerous conditions he met with in snow and storm induce a certain regret of the absence of meteorological observations from his wide range of subject-matter.

SIBERIA.

'Through the Highlands of Siberia.' By Major H. G. C. Swayne, R.E. Rowland Ward. 1904. Pp. xiv., 259.

In June, July, and August, 1903, Major Swayne made a sporting trip in the mountainous district on the Russo-Chinese border, about the valley of the Chuya, a headstream of the Katun, which joins the Ob. His hunting-ground of *Ovis Ammon* lay in the short ranges north of, and roughly parallel to, the western end of the Altai. Judging from his records, he may be congratulated on successfully accomplishing his purpose. He has also produced a book which not only gives a well-defined picture of the magnificent country which was his goal, but also contains many interesting impressions of that part of Siberia through which he travelled on the great railway and to the south of it. There is, probably, no more dangerous comparison to be made than one between the physical characteristics of the two widely different countries, but Major Swayne paints his picture of middle Siberia in summer, for example, by means of allusions to its likeness to an English countryside, and so the land is made to appear vividly to the eye. Nor are there wanting astute observations as to the methods of Russian expansion, its geographical limits, and the reasons why these will not, in his opinion, be overstepped. As regards strictly geographical interests, this, the first part of the work, is of the greatest value. The excellent illustrations, however, maintain these interests throughout; for the book is produced in the luxurious style commonly associated with Mr. Rowland Ward's sporting publications.

EASTERN SIBERIA.

'Glavnyeshiya Danniya po Statistik Naseleniya kranavo Vostoka Sibiri—Primorskaya i Amurskaya i Ostrof Sakhalin.' 1903. Published by the Statistical Committee of the Home Ministry.

In this volume M. S. Patkanof has collected statistical information concerning the population of the Amur and Maritime provinces and Sakhalin, and on the occupation of the inhabitants, with some ethnological notes, etc. Much of the information is not new. It is well known that colonization in the far east of Siberia, at any rate with the exception of the Ussuri districts, has not been attended with much success. One necessity is that Europeans should be able to multiply in these cold regions. As regards the Amur, the climate does not appear to have a disastrous effect on human life; seventy-seven persons have attained the age of ninety, of whom seven have lived to be more than a hundred, and the increase of population due to the excess of births over deaths is about 1·7 per cent. per annum. Agriculture is the chief occupation, 63 per cent. of the total population being engaged in it. Yet corn and cattle to a considerable value are imported from Manchuria. This results from the careless methods employed by the Russian settlers, who have not profited by the example set them by their Chinese and Manchurian neighbours. For cattle the pastures are little suited, and murrain is frequent. Sakhalin is still less prosperous. The natural increase of the population is insignificant, a fact accounted for, at least in part, by the great excess of males over females. The majority of the people are convicts and exiles. Corn yields a small return, and therefore potatoes are more extensively planted. Gold-mining, an important employment in the Amur province, is declining. In Sakhalin about 37,900 tons of coal were mined in 1899, and there is a prospect that gold-mining and the working of petroleum wells will be profitable in the future.

MANCHURIA.

'Manchu and Muscovite.' By B. L. Putnam Weale. Macmillan. 1904. Pp. xx., 552. *With a Map.*

Mr. Weale deals mainly with Russian misrule in the "railway province." His book was written before the outbreak of the war, but is intended as a statement of the conditions previous and leading to the crisis. By way of introduction, however, he gives a brief sketch of the history of the land now called Manchuria from the earliest times, treating it for this purpose from a right geographical standpoint. Thus he writes in his opening sentence that it must be considered simply as part of the whole area "which, stretching from the oases of what is to-day Eastern Turkestan, spread across the rolling plains and dismal deserts of Mongolia, jumped where is now the Great Wall of China, wound over river, mountain, and dale, and ended only with ice-cold waters of the furthest north-east." As an orographical synopsis, exception might perhaps be taken to this sentence, but the analysis of this great area into its former and existing political parts is most interesting. Coming to Manchuria itself, the reader is left without any very definite pictures of the land; it is, in fact, shown to him, so to say, from the railway-carriage window. The main interest lies in the descriptions of places, from Dalny and Port Arthur to Kharbin, as regards both their appearance and the curious atmosphere of corruption which appears to hang about nearly every walk of life in these Russian towns. The whole narrative can only be criticised as painted in somewhat glaring colours, leaving a certain suspicion of exaggeration through the very fact of the strong sentiment which obviously animates the author, perhaps best illustrated in the dedication "to the gallant Japanese nation." Finally, the general and statistical note on Manchuria, inserted as an appendix, seems rather unfortunately placed; it should surely rank alongside of the historical introduction. From the geographical point of view, it is, in fact, what the reader has been lacking all through the work. The illustrations and map are satisfactory.

AFRICA.

MOROCCO.

'Trois Mois de Campagne au Maroc.' By Dr. F. Weisgerber. Ernest Leroux. Paris: 1904. Pp. 240.

This work deals with that part of Morocco which extends from the Atlantic seaboard between Rabat and Cape Blanco southward (along the lines of longitude) to the city of Marrakesh, or Morocco, and thus, roughly, between 6° 30′ and 8° 40′ W. and 34° and 31° 30′ N., an area of about 15,000 square miles. The greater part of the book consists of a narrative of the author's journeys in 1897–98, which is of much interest, especially the portion which deals with his sojourn in the huge camp of Sokhrat ed-Jeja ("une immense cité de toile") when the sultan was engaged in person in the drastic "pacification" of the district. The description of his visit to the camp is made the occasion for a valuable review of the conditions and *personnel* of the Government. But the main geographical interest lies in the appendix of 80 pages, devoted to an "étude géographique de la région parcourue," and divided into sections of orography, hydrography, geology, climate, flora, fauna, and people. The district extends from the coast to the Atlas mountains, but does not touch the main range; and is divided into four zones—the coastal belt of the Sahel, widening from east to west from 10 to more than 20 miles; the lower terrace, a bare, very slightly undulating plain ranging from 500 to 800 feet or more in altitude; the upper terrace, of more broken country, where isolated elevations up to, or even exceeding, 3000 feet were observed, and the high plateau, formed

by what may be termed the higher foothills of the Atlas. The coast-line is composed mainly of sandy bluffs, with a low shore broken by lagoons and occasionally by rocky promontories, which partly shelter insignificant bays such as the anchorage at Casablanca. The sands of the coastal belt are continued into the Sahel, where the subsoil is calcareous. The region of the lower terrace is that of the *tirs*, the word signifying "les terres argileuses qui se crevassent en se déssechant." The soil is dark and fertile. The upper terrace, on the other hand, is for the most part arid and sterile, whether consisting of stony, sandy, or clayey tracts. Schists and quartzites are the principal formations of the high plateau. The chief stream of importance is Um Er-Rebia (Morbêa). The maritime climate of the coastal region is described as equable and temperate, though moist, but between the lower and upper terrace a transition takes place, rather suddenly as a rule, to a climate of continental character, dry and less equable. The illustrations in this book are few but good, and the diagrams are simple and clear.

O. J. R. H.

AMERICA.

United States.

'Greater America.' By Archibald R. Colquhoun. Harper Bros. 1904. Pp. x., 436. *With Maps.*

Mr. Colquhoun is deeply versed in large political problems, which he approaches with a proper appreciation of geographical considerations. Not that this volume has any affinity with that class of work which bases political theory on geographical fact, and sometimes tends to outrun actuality in giving rein to imagination. But, on the other hand, geographical facts are not forgotten, as not infrequently in attacking political problems they are forgotten. This book contains a series of simple but clear diagrams illustrating various subjects from racial distribution in the United States to the effect of the Panama canal in creating new world-highways, and each of the subjects thus illustrated is elucidated in the text. The completeness of the work may be shown by a selection of subjects—America's Pacific expansion and Caribbean expansion; Pan-Americanism in its associations with South America and with Canada; the government of "Greater America," and its connection with the problem of expansion at large; and American interests in Asia, which last involve a particularly succinct chapter entitled "Asia and Transformation." As regards the purely political side of the work, no more need be said here than that it gives a remarkably clear conception of the wide and growing ramifications of American interests. There may be noted, however, a few of the incidental sections which give the book a purely geographical interest. The chapters on Caribbean expansion contain a remarkable picture of the contrast between the desirable natural conditions and wholly undesirable human conditions, so to say, in the West Indian islands. Similarly, under the heading of Pan-Americanism in the southern continent each of the South American republics is taken up in turn, its political and economical state discussed, its natural opportunities set forth, and all compared and contrasted. Canada is similarly dealt with; the geographical reasons for her development along latitudinal rather than longitudinal lines, and her ethnological conditions in relationship to their bearing upon her imperial standing are not forgotten. The book is, in short, an application of the best methods of political geography to a special and essentially modern subject.

O. J. R. H.

THE MONTHLY RECORD.

ASIA.

The Name of the Highest Mountain in the World.—An able recapitulation of the various stages in the controversy on this subject, which has been maintained for so many years, was contributed by Major Burrard, of the Indian Survey Department, to *Nature* for November 10 last. Major Burrard appealed to geographers to accept the name Everest for the great mountain in virtue of the prescriptive title it has acquired by its use during a number of years, and the absence of any other generally acceptable designation. A brief reply from Mr. Douglas Freshfield appeared in the same journal for November 24.

Areas in Asiatic Russia.—We learn from our Honorary Corresponding Member, Colonel J. de Shokalsky, that the great work on the areas of river basins and administrative divisions in Asiatic Russia begun by the late General Tillo and continued since his death by Colonel Shokalsky, was about to be printed in December. The method employed in computing the areas is a new one, and of interest from a theoretical point of view. It gives exceedingly accurate results, which, in the case of Asiatic Russia, will be a decided improvement on those hitherto accepted, which have been based on the calculations of the late General Strelbitsky.

The Jarawas of the Andaman Islands.—We have received from Mr. C. G. Rogers, of the Indian Forest Department, a collection of official papers relating to recent journeys in the interior of the South Andaman island, undertaken by himself and other Government officials with a view to ascertaining the position of the settlements of the Jarawas, an aboriginal tribe, which has been much given to raiding the settlements on the coast, several lives having been lost through their means.* It is not quite clear, from the extracts printed, whether the expeditions were undertaken with a view to reprisals, or merely for the purpose of entering into relations with the Jarawas with the object of stopping their raids. On two occasions, however, attempts to capture individuals of the tribe were made, the second of which led to the death of Mr. Vaux, officer in charge of the Andamanese at Port Blair. The first report describes a reconnaissance made by this officer and Mr. Bonig, assistant harbour-master at Port Blair (in part in company with Mr. Rogers), in January and the early part of February, 1902. Proceeding to the west coast, north of Port Campbell, the party went inland through dense jungle and up the courses of mountain streams blocked by slippery rocks, but though one or two recently-occupied hunting camps of the Jarawas were discovered, none of the people were met with, although a small party came down to the beach in view of the launch during the leader's absence. The next attempt was made from Port Anson, the inlet leading from the west towards the Middle strait, and resulted in the discovery of one of the permanent settlements of the Jarawas, who were, however, away at the time. The hut was a substantial building measuring 60 feet by 40, and supported in the centre by seven stout posts 25 feet high, and it contained various utensils—honey and water vessels, baskets, mats, bows, etc. In the centre was the main fireplace, and round the sides the smaller fireplaces used by the separate families. The house was large enough to contain eighty to a hundred people, and the Andamanese state that the whole tribe collects into one such house

* An incident illustrating the irreconcilable character of the Jarawas, and their ignorance of the powers of the White man, is related in Mr. Kloss's recent work on the Andamans and Nicobars (p. 191).

(of the two or three which seem to exist altogether) during the rains, but Mr. Vaux considered this doubtful, as the men alone number, in his opinion, from eighty to a hundred. The house was placed on the summit of a hill, with paths leading up to it, the main approach being as well cleared as a Forest Department road. The next report is one by Mr. Rogers on a journey inland from the east coast, across the series of ridges running from north to south, which he thinks must number something like twenty. A large number of running streams of delicious water were crossed, and both Mr. Vaux and Mr. Rogers express the opinion that want of water cannot be the cause of the Jarawa raids, as has sometimes been thought. The forest was generally poor, consisting of small trees with a densely matted undergrowth, through which it is very difficult to force a way. A second expedition was undertaken towards the end of February of the same year, all three officers taking part. The first attempt was made from the west coast north of Macpherson's straits, but though an inhabited camp was discovered and surrounded, the attempt to capture the people asleep failed, two children only being secured. The party, therefore, proceeded to the big house near Port Anson, and after wandering through creeks, over precipitous hills and dense jungle for some time, succeeded in discovering the main track south and various Jarawa camps. One of these was found to be occupied, and another night attempt at the capture of its inhabitants made, which ended fatally for Mr. Vaux, who was transfixed by a Jarawa arrow and died within a few minutes. Two women and six children were secured, but, owing to the fatal mishap, no further attempt to capture the men was made. Drawings are given of several of the camps and of the big house near Port Anson.

The Minbu District, Upper Burma.—An examination of the vegetation of this district was made in 1903 by Captain A. T. Gage, I.M.S., curator of the Calcutta Herbarium, who reports on his observations in the *Records of the Botanical Survey of India* (vol. 3, No. 1). They are of interest as affording a good insight into the relations between physical conditions and vegetational features. The district lies roughly between 20° and 21° N., 94° and 95° E., *i.e.* between the Irawadi and the Arakan Yoma range. It consists of three meridional zones distinct both in their physical and vegetative characters. The first, in the west, comprises the eastern flanks of the Arakan Yomas and a very distinct narrow range of hills, to which, though not named on the map, Captain Gage applies the name "Nwamadaung hills." On the east there is an alluvial belt fringing the Irawadi, while the intermediate zone, occupying the greater part of the area, is named by the writer, for want of a more precise descriptive term, the "desert zone." It is drained by the three rivers, Salin, Mon, and Man. The Nwamadaung range, where traversed, was covered with fairly open deciduous forest. It being the hot weather, all the trees were leafless, while the shrubby undergrowth was scanty, and herbaceous vegetation practically non-existent. Palms and orchids are absent. Up to between 2000 and 3000 feet the Arakan Yomas are covered with practically the same forest as clothes the Nwamadaung range, but above 3000 feet the deciduous forest gives place to an evergreen forest. The flat alluvial belt is either cultivated, covered with savannah grass or with a thin sprinkling of trees, the toddy palm (*Borassus flabellifer*) being very abundant near villages. The shrubby element is varied, climbing plants naturally few, but herbaceous plants abundant. The alluvial belt vegetation is prolonged up the banks of the rivers. The desert zone, which becomes more rugged and hilly as one travels westward, has a characteristic vegetation of mixed gregarious species forming a spiny or prickly scrub. The difference between the flora of the Arakan-Nwamadaung and desert zones is entirely natural and dependent on difference of altitude and climatic conditions. The difference between the desert-zone flora and

that of the alluvial belt is chiefly due to the influence of the Irawadi, whose waters permeate the latter and allow many species to flourish which could not otherwise do so. The discussion of the affinities of the flora leads to some interesting results. The mountain zone shows a considerable percentage of endemic (Assam-Arakan) species, most of them new to science, while of the remainder, Burmese species come first, those common to India and Malaya second, and those common to China, India, and Malaya third. The alluvial belt has many general Eastern tropical or cosmopolitan tropical species, with some Indo-African; while the desert zone, though with a fair number of endemic Upper Burma species, is characterized above all by the preponderance of Deccan and Indo-African species. It is possible that this element is but the remnant of a flora once common to the Malay peninsula, India, and Africa (when the distribution of land and water was other than the present), but driven northward by the breaking up of land surfaces in the eastern peninsula, with the change of climate thereby brought about.

Place-names in the Travels of Pedro Teixeira.—Colonel Gerini, whose long-continued study of the historical geography of the Far East entitles him to speak with authority, gives a note in the *Journal of the Royal Asiatic Society* for October, 1904, on the identification of some place-names mentioned in Teixeira's travels lately printed by the Hakluyt Society. The first of these is "Olanion," a kingdom producing benzoin, which he shows with great probability to be merely the transcript into Spanish of the Portuguese Lanjão with the article prefixed. The realm is thus the Lanjioni of the Italian missionaries, Lan John of early English travellers, properly Lan-cheng with its capital Wieng Chan on the middle Mekong. "Pole," again, is the Pulai river near the old Singapore strait, which Colonel Gerini had previously been led to connect with one or other of the states named Po-li in the Chinese records. "Pate," a seaport on the east coast of the Malay peninsula between Siam and Patani, with rich mines of tin near it, he takes to be the same as Tavernier's *Bata*, which is mentioned in conjunction with *Delegore* (Ligor), *Sangore* (Senggora), and *Bordelon* (Phattalung), and which would seem to be either Patanor, Bordia, or Pateo, most probably the first named, near which tin was certainly worked in Tavernier's time. The state of Po-ta, referred to in the annals of the first Sung dynasty in China, may be this same *Bata* or *Pate*. Lastly, "Sabam strait" (Sabão of the Portuguese) is that between the Karimun-Kundur group of islands and those bordering the east coast of Sumatra. It takes its name from Sabong, formerly applied to the islands south of the Great Karimun.

AFRICA.

The Tanganyika Problem.—The present position of the problem connected with the origin of Lake Tanganyika and its fauna of apparently marine affinities has been ably summed up by Mr. W. H. Hudleston in a paper read before the Victoria Institute in May, 1904, and printed in vol. 36 of the *Journal of Transactions* of that body. In the first section Mr. Hudleston discusses the views of Mr. J. E. S. Moore from the point of view of general zoological and palæontological considerations, passing in the next to an examination of our existing knowledge of the geology of equatorial Africa, of which he supplies a useful summary. In dividing the whole of Africa into three great divisions, viz. the Northern, the Region of Great Deserts, and Peninsula Africa, he points out the marked difference which exists between the two last, in that, while in the second division fossiliferous marine beds of Mesozoic and Tertiary age penetrate into the heart of the continent, in the third such beds occupy but a narrow fringe between the sea and the peninsular massif. In considering the geological aspects of the Tanganyika problem,

it is necessary to have some idea of the geology both of the East African system of ranges and of the Congo basin, since the lake lies in the border zone between the two. In the former the primitive crystalline system has been invaded by an enormous extent of volcanic extravasations, the date of which may be safely said to be post-Jurassic, probably considerably later, the first series of rift-valley faults dating likewise, in all probability, from so late a period as the Upper Eocene. The Congo basin, as is well known, is marked by two great series of sandstone formations probably covering more ground than any other sedimentary beds throughout Africa, which are probably contemporaneous with the Karroo of South Africa, and give no sign of marine origin. They seem to be mechanical sediments, which accumulated at a time when the basin had no drainage outlet. The basin, as a whole, is outside the influence of the East African disturbances, but the Red Felspathic grits, the lower of the two series, are occasionally tilted in the Tanganyika region, into which they extend. The lake has therefore come within the influence of those disturbances. In the third section the writer sums up the conclusions to be drawn both from the zoological and palæontological evidence and from the geological facts. He points out that the undoubted peculiarities of the Tanganyika fauna have so far failed to establish any connection with the inferior Oolite of the Anglo-Norman basin, while the character of the Jurassic fauna of intermediate areas likewise does nothing to bridge over the divergence. Nor, again, does the fauna of known Jurassic deposits within the African tropics show any analogy with the gasteropod fauna of Tanganyika. The geological argument tends in the same direction. The origin of Tanganyika as a rift-valley lake cannot be older than Middle Tertiary, while, although large lacustrine sheets of a different character no doubt existed earlier, the geological history of the Congo basin gives no indication of the presence of a Jurassic or even a Cretaceous sea. The problem in its main features must thus be regarded as still unsolved.

Prof. C. Uhlig's Scientific Researches in East Africa.—A letter from Prof. Uhlig, who early in 1904 went out to East Africa at the expense of the Otto Winter Fund for the purpose of scientific research, appeared in *Petermanns Mitteilungen*, No. 9, 1904. From this it appears that the professor's work is likely to be fruitful in additions to our knowledge of the physical geography of that region. He had made a careful examination of the shores of the Victoria Nyanza, and had brought to light the existence of recent volcanic formations on the east coast near the southern boundary of British territory. Inasmuch as the deepest sounding hitherto obtained by Commander Whitehouse (269 feet) was in this neighbourhood, Prof. Uhlig is inclined to think that a recent subsidence has taken place here. On the south-west coast he also saw indications of recent tectonic disturbances, and thinks that the line of islands off the coast is of the nature of a much-broken "Horst." (In this he is in agreement with Captain Herrmann's views, cf. *Journal*, vol. 15, p. 179.) The traveller had subsequently proceeded to Mount Kilimanjaro, where he had noted the surprising fact that, in spite of an unusually heavy rainy season, the ice on the Kibo crater showed marked signs of retreat as compared with former observations.

The Uganda Protectorate in 1903-1904.—The general report of Colonel Hayes-Sadler, commissioner for the Uganda protectorate, which was presented to Parliament in November last, is one of the most encouraging documents that have come from the British African possessions for some years. In the words of the commissioner himself, "The general results of the year may be summed up in increased efficiency of administration, and the maintenance of undisturbed peace and order; in a satisfactory increase of revenue and decrease of expenditure; in a large expansion in trade, particularly in imports; and in a general advance in

material and social well-being, despite the fact that progress was hampered by the continuance of the sleeping-sickness epidemic." It is naturally in the headquarters of the protectorate, or Uganda proper, which possesses the advantages of direct steam communication with the coast, and the resulting closer touch with the outside world, that most signs of progress are observable. Especially good results have been obtained from the system which has been introduced of collecting the hut tax, when possible, in salable produce, which is immediately handed over to the merchants, and thus gives an important stimulus to trade and agriculture. An increase of prosperity and well-being is said to be apparent on all sides in Entebbe and Kampala, where new shops have been opened, and new industries started, all shops and dwelling-houses of the traders being now built of brick and iron. The number of rupees in the country has been largely increased, and the introduction of a very small copper coin to take the place of the cowrie is under consideration. The Lukiko, a native council, has done good work, and its measures and decisions appear to give general satisfaction. In the central province (Busoga, etc.) a good start has been made towards acquiring a firmer grasp in matters of administration, steps having been taken to train up the younger men for their future duties as chiefs. In Ankole, the healthiest part of the protectorate, a distinct change for the better has made itself felt, and the people are content and satisfied with their present state. The Nile province suffers from its remote situation and difficulties of communication, which makes it impossible to exercise control over the inland tribes. The telegraph has, however, been carried to Wadelai, and will soon be extended to Nimule. Considerable progress has been made with the work of the survey department of the protectorate, the staff of which has been much increased. Plane-tabling was carried out over an area of 5200 square miles, making a total of 7000 since the beginning of the work. Observations with the 10-inch theodolite were taken over 2465 square miles, and 116 miles of secondary triangulation completed, 450 miles being mapped in detail on the 1-inch scale. The admirably appointed steamers of the Uganda railway are doing good service. They call weekly at Entebbe, Munyongo (the port for Kampala), and Jinja, while one steamer makes the tour of the lake once a month. The scientific and forestry department is doing good work, especially in the study of products likely to have an economic value. The Botanical Gardens have been considerably enlarged, and experimental plantations established in Buddu and the Sesse islands. Lastly, the system of meteorological observations established in 1901 is being constantly extended. The year 1903 was a record one for rainfall, which reached a total of 62·88 inches.

Dr. David's Journeys around Ruwenzori.—A further note on Dr. David's ourneys (*Journal*, vol. 24, p. 348) has appeared in *Globus* for October 13, 1904. Writing to Dr. Schweinfurth on August 22, from the shores of Lake Albert Edward, Dr. David reported that he had proceeded from Toro to the Semliki valley in a single day by a mountain pass 6230 feet high, reaching in this way the damp mountain forest which extends between the Semliki and the range. In about 40′ N. he had discovered a series of boiling-hot sulphur and brine springs, over twenty in number. The trip had been an unfortunate one, as he had fallen into the hands of marauding Banyoro, who had led him astray for eight days through the forest, with the result that he had lost all his *impedimenta.*

Hydrographical Survey of the Senegal and Niger.—An important undertaking, having in view the thorough examination of the channels of the Senegal and upper Niger and their improvement for purposes of navigation, was set on foot a couple of years ago by the governor-general of French West Africa, and has already led to valuable results (*La Géogr.*, vol. 10, 1904, p. 187). The head of the mission is Lieut. Mazeran, previously known for his excellent work

on the Mekong, who is supported by Lieut. Dyé—a member of the Marchand expedition, and known to geographers for his excellent surveys in that capacity—and a number of other assistants. The work in West Africa has been done in the most complete and careful manner. The first task was to execute a large-scale survey of the river-channels and banks; the position of every rock, sandbank, and other danger to navigation being marked, the depths accurately determined by soundings, and the contour of the banks mapped in detail. This has been carried out for the Senegal alone over a distance of more than 550 miles. Another important piece of work was the beaconing of the course of the Senegal, which has long been urgently needed in the interest of safe navigation, many disasters having occurred through the want of such precaution. It has already been carried out over more than half the course of the Senegal, the beacons including some twenty masonry towers of 40 feet high, in addition to over a thousand iron posts. As an outcome of the work of the mission, it is proposed to set on foot works for the improvement of the river-channel in the form of weirs, embankments, dredging, and the like.

New Reorganization of French West Africa.—The administrative system introduced into French West Africa by the decree of October 1, 1902 (cf. *Journal*, vol. 21, p. 188), has now been modified by a decree signed by the President of the French Republic on October 18, 1904. The new organization involves not so much a change in principle, as has been the case with many of the previous changes introduced into the administration of these territories, as an extension in greater detail of the principle already adopted. Thus the independence of the governor-general of local considerations, and the general supervision exercised by him over the whole territory, is further promoted by the erection of the wide territories of the interior into a regular "colony," under civil administration, to be known as the "Colony of the Upper Senegal and the Niger." This will begin (from the west) at Kayes, the former "pays de protectorat" on the left bank of the Senegal being now added once more to the Senegal colony. The chief centre of the new colony will be at Bammako, which is bound to take an important place in the development of these interior territories as the terminus of the Senegal-Niger railway, now completed. The civil portion of the colony will include *inter alia* the area formerly known as the second military territory, while a military territory will also be attached to it, formed by the existing first and third military territories, to be placed under a single "commandant," responsible to the lieut.-governor of the colony. The colonies of French Guinea, the Ivory Coast, and Dahomey suffer no change of limits. A further modification introduced by the new decree is, however, the formation of a new civil territory embracing the Moorish districts to the north of the Senegal, lately brought under French influence, but not yet fitted for an administration such as is in force in the more settled districts in Senegal proper. This will be known as the "Civil territory of Mauritania."

AMERICA.

Northern Alaska.—The account of a reconnaissance, carried out under the U.S. Geol. Survey Department by Mr. W. C. Mendenhall, adds considerably to our knowledge of the geography and geology of Northern Alaska (U.S. Geol. Survey, Professional Paper No. 10, Washington, 1902). Leaving Fort Hamlin June 18, 1901, the party ascended the Dall river, arriving on the 27th at "Dall City." The lower 50 to 60 miles of the Dall—half its length—lie within the Yukon flats, a region of sloughs and ponds. For 25 miles below the "City," the Dall runs through a broad valley bounded some distance on either side by hills approaching the river and rising in height towards its source. The divide between the Dall and Koyukuk is 3000 to

3500 feet above the sea, the gap at head of the Dall being a cut 1500 feet below this level. From Dall City the survey made a portage of 18 miles to the Kanuti river, involving a climb of 2500 feet. Two hundred miles long, the Kanuti, a few miles from its source, enters a flat basin 9 to 10 miles long by 5 broad. At its lower end it runs for 30 miles—a stretch scarcely navigable—through a canyon reaching 2000 feet in depth. Twenty-five miles above its mouth it plunges into a second canyon 10 miles long by 500 feet deep, and 10 miles above its mouth it receives the Mentanontli, descended by Allen in 1885. The hills bordering this lower section, 1500 feet high, are well timbered. Ducks and geese abound on the Kanuti. Descending to Koyukuk, the party ascended the Allen, which is free from serious rapids. Its lower valley, above the flats adjacent to its mouth, is 5 to 10 miles wide, and bordered by rounded hills reaching to a height of 2000 to 2500 feet. Helpmejack creek, 90 miles from mouth of Kanuti, is the first important affluent of the Allen encountered in the ascent, and enters the main stream through a canyon-like north-to-south valley. The survey reached the Allen on July 24. Between Allen and Kowak there was a portage of 5½ miles, with a climb of only 300 feet. The Kowak, reached August 10, rises north of 67° N. and west of 154° W. At the mouth of the Kichaia Kaka affluent the Kowak is a beautifully clear mountain stream, 125 feet wide and 6 to 8 feet deep. Near the head of the river the valley is fully 3 miles wide and broadens below Walker lake, which is drained by its upper waters. This, the most important of the Kowak's upper lakes, is 14 miles long, 2 miles broad at its southern, and 1 mile at its northern end. It is bordered on both sides by precipitous mountains rising 3000 to 4000 feet. Nutavukli lake, half the size of Walker, was reached August 13, and next day the lower gorge of the Kowak. West of this, the valley, broadening at 154½° W. to 10–20 miles, maintains this width to 160° W., where it suddenly contracts till only 2 miles wide. Thence it again broadens to the head of the delta, where it enters a great flat. Among its numerous tributaries the most important is the Ambler from the north, joining the Kowak at 158° W. Below Squirrel affluent the Kowak breaks into a number of channels expanding into the maze of intricate sloughs which make up its delta. The complex of more or less schistose sediments near the base of the geologic scale of Alaska, described by previous geologists, is discussed in detail.

Exploration in Western Mexico.—Dr. O. C. Farrington, of the Field Columbian Museum, Chicago, describes a journey made in 1896 in the Sierra Madre of Mexico, west of Durango, in publication No. 89 of the Museum (Geological Series, vol. 2, No. 5). The physical geography of this part of Mexico is still little known, none of the few writers who have touched upon it (including Dr. Schiess, of whose journey* Dr. Farrington does not seem to be aware) having possessed special competence in this respect. The present *brochure* is therefore of considerable interest, especially as it contains some excellent photographs of the characteristic scenery of the country. An important point discussed by the writer is that of the history of the drainage system of the region about Durango. While the suburbs of this town are drained by the Rio Tunal, which flows through the Mezquital into the Pacific, the longitudinal valley to the north is drained by streams which unite from north and south courses to flow eastward as the Nazas, terminating at the present day in the Laguna de Mayran, which has no outlet. The existence in the Nazas of species of fish which also occur in the Rio Grande points to the former existence of a connection, now interrupted. While this may

* *Journal*, vol. 21, p. 543. See also a note on a geological examination, by Mr. W. H. Weed, of a more northern section of the range in *Journal*, vol. 22, p. 462.

have been in part due to a warping of the valley or to increasing aridity of climate Dr. Farrington is inclined to attribute the diminution of the eastern waters to abstraction by westward-flowing streams, pointing to the fact that the Tunal likewise contains Rio Grande species, as an indication that this river has probably cut back into streams that once flowed eastward. West of Durango the country continues arid for some distance, but extensive forests of pines, interspersed with oaks, soon make their appearance. Apart from a few unimportant ranches, the region is uninhabited, though pack-trains were met at least as often as once a day. The plateau rises steadily towards the west, and at the higher levels the temperature is too cold for wheat, though grass grows in abundance, and mountain streams with clear waters were crossed at intervals. Dr. Farrington left the trail to inspect the strange natural phenomenon known as the "city of rocks," of which he gives some striking views. These rocks are marked by the rounded outlines characteristic of weathered surfaces, but a remarkable feature is the complete removal of the products of decay, probably due to the texture and composition of the rock (a rhyolite) and to the scarcity of joints. A few hours west of the "city" the western edge of the plateau is reached, a maze of peaks and valleys—due evidently to a profound dissection of the edge of the plateau by short swift rivers—comes into view, the valleys nearest the plateau often having the form of an amphitheatre. The structure outlines of many of the peaks suggest sedimentary rocks, though eruptive rocks probably prevail. In descending westward all gradations of temperature are experienced, while the abundant vegetation of the upper and middle slopes gives place lower down to semi-arid conditions, caused probably by the warmth of the land, which prevents sufficient cooling of the winds to produce precipitation until the summit is reached. The uninhabited character of the region traversed is due, however, not to climatic conditions, but to the tremendous barriers to traffic presented by the topographical features. The paper concludes with a description of the Cerro Mercado, a hill largely made up of solid iron ore, which lies a little to the north-east of Durango.

The Falkland Islands and their Stone-rivers.—In a recent number of the *Memoirs of the Manchester Literary and Philosophical Society* (vol. 48, part 3), Mr. Rupert Vallentin gives some notes on a visit to the Falkland islands in 1900, chiefly for zoological research, with the results of which the greater part of the paper is taken up. There are, however, some observations of geographical interest, in particular on the mode of formation of the stone-rivers which have engaged the attention of most visitors to the group. Mr. Vallentin would regard these not as streams of *débris* brought down from the hillsides, but as portions of the general substructure of the islands laid bare by the removal of the peaty soil with which it is elsewhere covered. The stones, in his opinion, have existed for ages in their present positions, vegetation having subsequently spread over the land owing to changes of climate. He says that on digging into the peaty soil at the foot of every stone-run, rocks identical both in form and structure to those already exposed can be uncovered, while a stream of underground water can be detected, which is constantly carrying away the soil. The amount of soil carried down by the torrents from the hillsides after a heavy rainfall is shown by the depth of mud in the various creeks and harbours. The islets of vegetation to be found in all stages of formation in every stone-run, of which excellent photographic illustrations are given, are regarded as remnants of the former coating of vegetation. Among other localities, Mr. Vallentin visited Roy cove in the West Falklands, where he found the scenery and vegetation far more attractive than in the neighbourhood of Port Stanley, the high grass and higher Fachina bushes (*Chilabothrium*) giving an agreeable finish to the landscape. On some small islands the tussac

grass formed a high and dense growth. The sides of all the estuaries and coves in this part of the group are almost fringed with the beautiful and fragrant Falkland box (*Veronica decussata*), which is used as a sheltering hedge in many of the gardens. Ferns, including a pretty tree-fern (*Gleichenia*), were also seen. The bog-balsam (*Bolar glebaria*), though still very common, does not attain the size it formerly did, owing to the trampling of sheep, which bruises the hard exterior and causes rapid decay. Mr. Vallentin gives an interesting account of the penguin rookeries, and adds a list of the fauna, mainly consisting of birds. His inquiries as to the now extinct Falkland island wolf led him to believe that this animal possessed a social habit.

AUSTRALASIA.

Queensland Farming Industries.—The Government statistician's report on the agriculture of Queensland shows that on December 31, 1903, there were depastured in the state 401,984 horses, an increase on 1902 of 2862; 2,481,717 cattle, a decrease on 1902 of 61,754; 8,392,044 sheep, an increase on 1902 of 1,178,059; 117,553 pigs, an increase on 1902 of 40,351. Within the last decade there is a remarkable decrease in the number of cattle and sheep. Whereas in 1894 there were 7,012,997 cattle, in 1903 there were only 2,481,717, a decrease of 65 per cent. Sheep, too, have decreased from 19,587,691 in 1894 to 8,392,044 in 1903, or 57 per cent. Though its climate and pastures are admirably fitted for horse-breeding, Queensland has as yet little profited by this fact. During the Boer war in 1901 and 1902, 20,000 horses were with difficulty supplied to Africa, and these mostly not of a creditable type. Upwards of three-fourths of the cattle are held, in herds of not less than 300 in number, by 4 per cent. of the total number of owners, which reaches 23,610. The 8,392,044 sheep returned for 1903 were, on the other hand, owned by only 1914 persons. Of these 5,097,247 were owned by 115 persons, giving to each 44,324 sheep, but for a number of years sheep-farming has been tending in the direction of smaller flocks and holdings. In 1894 the average number of sheep to each owner was 12,366, and in eight to nine years this figure dwindled to one-third. Taking ten head of sheep as equivalent to one horse or head of cattle, the total number of horses, cattle, and sheep in Queensland in 1903 gave 56 sheep or their equivalent to each square mile, and 72 to each inhabitant. The total export of wool, scoured and greasy, in 1903 amounted to 34,979,076 lbs., of the value of £1,883,752, an increase on 1902 by 5,124,496 lbs., valued at £572,826. Of the exported products of the state, totalling £9,087,874, the pastoral products were valued at £4,221,780, or 46 per cent. of the whole. In 1903 there were 18,750,604 gallons of milk dealt with for conversion into butter, against 13,787,175 gallons so used in 1902. In 1903 the land under cultivation comprised 621,693 acres, of which 566,589 were under crop. Passing by 1902 as a year of drought, the figures in 1901 were 507,317 acres under cultivation, and 483,460 acres under crop. The quantity of cultivated land to which water was artificially applied was, in 1903, 14,786 acres against 14,344 in 1902. The report gives satisfactory returns of the corn crops, and those of sugar, coffee, pumpkins, fruit, vines, etc.

The Dutch Expedition to New Guinea.—An important expedition for the purpose of exploring the interior of Dutch New Guinea, organized under the auspices of the Netherlands Geographical Society, started early in 1904 for the scene of its labours, and some account of its proceedings down to June 18 last has been given by Mr. J. W. Ijzerman in the *Tijdschrift* of the Society above mentioned (1904, No. 5). The leader is Mr. R. Posthumus Meyjes, who has with him various assistants, including Dr. Koch as natural history collector. On the

way out to the East, Mr. Meyjes stopped at Florence, where he met and consulted with Sir W. MacGregor, the naturalist travellers Beccari and Loria, and Prof. Giglioli. After the arrival at Batavia, some time was taken up in preparations, including arrangements for coolies, military escort, and so forth. Arriving at Merauke (New Guinea) on April 5, Mr. Meyjes did some preliminary work in the way of surveys and observations on the south coast of New Guinea, making a trip also to Thursday island in order to connect his surveys with previously fixed positions. During the voyage along the coast he was gratified with an unusually clear view of the mountain range, the exploration of which is one of the objects of his expedition. It seems to have left no room for doubt that a part, at least, of the range—that north of Pisang bay—is snow-clad. One peak appeared to be entirely white, with streaks of snow as if surrounded by glaciers. During an investigation of the coast east of Puriri a river was discovered—the Tania or Utakwa (possibly that marked on the map as the false Utanata), the entrance to which seemed to be more practicable than of most, probably allowing the passage of a vessel drawing 11 or 12 feet at high water and in calm weather. It was hoped that this river might afford a means of penetrating inland. Further east there were many river mouths, broad but shallow, forming apparently a great delta. At the date of his last letter, Mr. Meyjes had returned to Surabaya and Batavia to make the final arrangements for the main expedition.

POLAR REGIONS.

Proposed Scientific Station in West Greenland.—Mr. Morten P. Porsild, assistant in the Botanical Garden at Copenhagen, has proposed that a permanent scientific station should be established in West Greenland, preferably on the south coast of Disco. Mr. Porsild took part in the Steenstrup expedition to West Greenland in 1898 as botanist. He published the botanical results (*Meddelelser om Greenland*, part 25), and again visited Greenland in 1902. His view that a fixed biological observatory is necessary to secure completely satisfactory results may be accepted. For one thing, remains of plant life might be discovered which would throw light on the history of the Greenland flora from remote times. Many other questions bearing on Arctic geography and geographical distribution might be solved by patient research from a fixed station in Greenland properly equipped. It is to be hoped that Mr. Porsild may be successful in obtaining the necessary funds for such a laudable undertaking.

Antarctic Medallists of the R.G.S.—A list has been compiled by the President of all the recipients of medals and other awards given by the Society for Antarctic exploration. It has been bound and placed in the library, where it will be available for reference. Naturally the bulk of the compilation has to do with the recent Antarctic expedition, the names of all the officers, members of the scientific staff, and men being chronicled, with a statement of the total amount of sledge-travelling accomplished by each, as well as of the longest continuous sledge journey. The earlier awards are eight in number, the recipients being Captain John Biscoe, Sir James Ross, Sir Joseph Hooker, Captain Charles Wilkes, Captain C. A. Larsen, M. H. Arçtowski, Captain W. Colbeck, and Mr. L. C. Bernacchi, the last two having received grants in 1901 for their work with the Newnes Expedition.

GENERAL.

The Wak-wak Islands of the Arab Geographers.—M. Gabriel Ferrand discusses the identification of the Wak-wak islands of Al Hamdani, Ibn Khordadbeh, Masudi, and other Arab geographers, in a recent number of the *Journal Asiatique* (vol. 3, No. 3, 1904). The first-named distinguishes the Wak-wak

islands of China from those of the south, and the former have been shown with reason by Mr. J. de Goeje, in an appendix to the 'Book of the Marvels of India (Leyden, 1883–86), to represent Japan. Definite statements as to the position of the Wak-wak islands of the south are made only by Masudi and his copyists, who associate them with Sofala and Zanguebar, and say that as the country of Sila (Japan) forms the limit of the Chinese sea, so the Wak-wak country is the furthest bound of the Sea of Zenj. Vague attempts have been made to identify this country either with the Seychelles or some other islands off the east coast of Africa, or even with the district of Ugogo inland from Zanzibar. M. Ferrand holds that it can only represent Madagascar, and gives two possible explanations of the name consistent with this identification. The first is from the Malagasy word *vahuaka*, in constant use in the senses of "kingdom," "subjects," "people," etc.; the second from the Malagasy name of the *Pandanus utilis* (*Vakua*). He inclines to the latter, as supplying some clue to the story of the marvellous tree of the Wak-wak country related in the 'Marvels of India,' the fruit of which resembled the head of a woman suspended by the hair, and when ripe emitted the sound of "wak-wak." The supposed existence of two distinct groups of islands bearing the same name, in such widely separated quarters as Japan and Madagascar, he attributes to the influence of the Ptolemaic idea of a closed Indian ocean, also suggesting that the similarity between the Malagasy word *Vakua* and the ancient Chinese name for Japan, Wo-kwok, may have led to the transference of the Malagasy legend to Japan. Attention is also called to the Swahili name for Madagascar, Buki, which cannot be derived from any Bantu root. M. Ferrand says that if his theory is accepted, it will be necessary to revise the currently accepted Arab geography in other points also.

The Explorers' Club.—The first general meeting of "The Explorers' Club," a recent organization to further general exploration, was held in New York City on November 12. The club was organized last spring by about fifty persons, and at the meeting on November 12, General A. W. Greely was elected the club's President for the ensuing year. The club has for one of its objects to bring the achievements of explorers to the attention of the public, and to secure public interest and co-operation therein. It will maintain headquarters in New York City, where the members can meet for social purposes, and where receptions can be tendered to explorers on their return from notable expeditions, and to foreign explorers of distinction visiting the United States. An exploration fund will be inaugurated, while illustrated lectures will be given from time to time at the club's headquarters. Following the business meeting, a banquet was served to sixty members and guests, among whom were, besides General Greely, who presided; Dr. A. F. Bandelier; Commander Robert E. Peary, U.S.N.; General Henry T. Allen, U.S.A.; Dr. Carl Lumholtz; Count Joachim von Pfeil; Dr. F. A. Cook; Colonel David L. Brainard, U.S.A.; Mr. Caspar Whitney; Mr. Frederic Palmer; Mr. Richard Harding Davis; Dr. Nathaniel L. Britton; Mr. Henry Collins Walsh; Dr. Donaldson Smith; Mr. Henry Biederbick; Major W. R. Abercrombie; General Frederick Funston, U.S.A.; George Bird Grinnell; Mr. F. S. Dellenbaugh; Mr. Henry G. Bryant; Mr. Oscar F. Crosby; Dr. William H. Furness; Mr. Alfred C. Harrison, jun.; Dr. H. M. Hiller; Mr. Henry C. Mercer. Interesting remarks were made by Dr. Bandelier on his recent travels in Bolivia and the Andes; by Count von Pfeil on his recent visit to the interior of Morocco; by Dr. Cook on Antarctica; by Mr. Frederic Palmer, war correspondent, on the operations of the contending armies in Manchuria, which he witnessed until October 1; and by Mr. Henry Collins Walsh, secretary of the club.

OBITUARY.

Lord Northbrook.

ALTHOUGH rather a statesman than a geographer, the late Earl of Northbrook, whose death occurred on November 15, 1904, was intimately connected with our Society, not only by membership lasting a quarter of a century, but by his tenure of the office of President at the very beginning of that period. This was in 1879–80, the year previous to his joining Mr. Gladstone's second administration as First Lord of the Admiralty, to which circumstance, and to the calls thus made upon him by the public service, was alone due the comparatively short period during which he retained the office. Short though it was, it was sufficient to prove his eminent qualifications for the task of presiding over the Society's meetings, at a time when the geography of the Indian frontiers was a subject of frequent discussion, and when his wide experience of Eastern affairs, gained as Viceroy of India, thus proved of especial value. In the social side of its activity, the Society likewise found in Lord Northbrook an excellent head, and to his urbanity and open-hearted hospitality a considerable portion of the success attending his year of office was no doubt due.

This is not the place to enter into a minute account of Lord Northbrook's public services, which have been adequately dealt with by the public press. The family of Baring, of which Thomas George, second Baron and first Earl of Northbrook, was the distinguished head, migrated to this country from Bremen early in the eighteenth century, and soon made its mark for the business capacity which has characterized so many of its members, and which during two generations was placed at the disposal of the East India Company. The father of the late earl was Sir Francis Baring, who, after a long period of public service, became first Baron Northbrook in 1866. Born in 1826, the earl, after graduating with classical honours at Oxford, served his apprenticeship in public affairs as private secretary to various heads of Government Departments, and entering Parliament in 1857, took office himself, first as a Lord of the Admiralty, next as Under-Secretary of State for India, and soon afterwards as Under-Secretary for War. In 1872 he succeeded the murdered Lord Mayo as Viceroy of India, his four years' tenure of which office was marked by a cordial sympathy with the feelings and aspirations of the Indian people, by useful reforms in the region of finance, and by the successful fight which he maintained against the horrors of famine in Bengal. The period was on the whole one of quiet and unsensational progress, and the chief public event was the successful visit of the Prince of Wales to India in 1876. Lord Northbrook left behind him in India many kindly memories, and his administration was certainly a beneficial one to the people at large, and tended to draw rulers and ruled into closer and more harmonious relations.

After his return to this country, Lord Northbrook remained out of office until the return of his party to power as the result of the general election of 1880, when, as already stated, he became First Lord of the Admiralty, under Mr. Gladstone. It was while holding this office that he was sent out, in 1884, as High Commissioner, to inquire into the financial position in Egypt, and that the advice which he gave in this capacity led to no practical result must be ascribed to the international fetters which hampered all true progress, and from which the country has only lately been freed as the result of the Anglo-French convention of 1904. Lord Northbrook's public career came virtually to an end with the political upheaval of 1886, in which he ranged himself on the side of the Unionists.

Lord Northbrook took to the end a lively interest in the affairs of Hampshire, in which his country seat was situated, being Lord-Lieutenant of the county, and chairman of the County Council as well as of its Education Committee.

Dr. Emil Schlagintweit.

The well-known writer on Eastern subjects, Dr. Emil Schlagintweit, died on October 29 last, at the age of 69 years. He was the youngest of four brothers, of whom the three elder, Herrmann, Adolf, and Robert Schlagintweit, are so well known to geographers for their important researches in the Himalayas and adjacent regions, carried out about the middle of the last century under the auspices of the Indian Government. The fourth brother, Emil, who, as we learnt from a short notice in *Globus* (vol. 86, No. 20), was born in Munich in 1835, had his attention turned to things Eastern, and especially to the history and literature of Tibet, as a result of his brothers' researches, and his close study of these subjects had its outcome in several important works, which appeared between 1863 and 1896. Another and more popular, though a careful and accurate work, was his 'Indie in Wort und Bild,' which originally appeared in 1880–81, a second edition being called for in 1890. Dr. Schlagintweit several times took part in the controversy regarding the snow-peaks visible from Khatmandu, holding that the Gaurisankar of his brother Herrmann was identical with the Mount Everest of the Indian Survey Department.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904–1905.

Second Meeting, November 21, 1904.—Sir CLEMENTS MARKHAM, K.C.B., in the Chair.

ELECTIONS.—*Robert à Ababrelton; George Frederick Andrews; Rear-Admiral Charles Arbuthnot; Oliver Bainbridge; Sir Alexander Baird, Bart.; J. Benson* (*5th Fusiliers*); *Arthur Boake; John Buchan; Charles Gerald Bush; Henry Adolph Bush; Rev. S. R. Cambie; Luigi Camera; John Campbell; Edmund Drinkwater Carver; Cyril Claridge Chambers; H. P. Chamley; Lieut. Sydney Herbert Charrington* (*The King's Hussars*); *Commander Louis Wentworth P. Chetwynd, R.N.; Charles A. Clark* (*late Lieut., U.S.A.*); *Captain Frederick Laurence Stanley Clarke* (*30th Punjabis*); *Frank Benedict Cleland; G. R. Clerk; Lieut. Edward Clive Coates* (*15th Hussars*); *Charles Curtis Craig, M.P.; Eliot Crawshay-Williams* (*late Royal Field Artillery*); *William Penn Cressen; Alfred Herbert Crook* (*Queen's College, Hong Kong*); *George Crowther; Major-General James Turner Cummins, C.B.; Thomas Kirkman Dealy; Robert Paget Dewhurst; Edwin S. G. Dottridge; John Edwards* (*South African College School*); *Captain England, R.N.; Rupert G. England; C. Reginald Enock; Patrick Gibson; John A. Ley Greaves; Herbert Guernsey; Captain Clarence Preston Gunter, R.E.; J. G. Hamilton, M.V.O.; Frank E. Harvey; George Leonard Harvey, C.E.; Captain G. J. Henderson, R.F.A.; James Clement Holden; Herbert C. Hoover, M.E.; Hon. Oliver Howard; Edward Hutchinson; Charles Inglis Hutton; James Thorburn Irvine; Captain Lionel James* (*4th Co., London I.Y.*); *Lieut. George William Jenkins, R.N.R.; B. H. Jessen; Joseph Kennedy, I.C.S.* (*retired*); *Arthur Laughton; Alfred Perkins Merrill; John Francis Molyneux, M.R.C.S.; R. Hervey de Montmorency; Benjamin Henry Hutton Mundy; Leonard John Newmarch; Captain Francis Charles Methuen Noel, R.N.; John Switzer Owens;*

Lieut.-Colonel Malcolm Peake, R.A.; Prof. Raphael Weller Pumpelly; John William Ramshaw, A.C.P.; Captain Frederick St. George Rich, R.N.; Frank Sherwin Richardson; Reginald A. Roberts; Rev. Leonard Robin; George H. Robinson; Charles Russell; Wm. Morris Schlesinger Selwyn; Captain G. C. Shakeley (King's R.R. Corps); Lieut.-Colonel Robert John Simpson (R.A.M.C., C.M.G.); Sydney Frank Smith; Frank Spenlove-Spenlove; Dr. J. F. Stewart; P. C. Anstruther Stewart; David Croal Thomson; John T. Thomson; Lieut. Frederick Edward Thornton (Royal Scots Fusiliers); George Threlfall; Ivon Tuxford; Major John Vans Agnew (Indian Army); Alban Voigt; Captain Thomas Philip Walker, R.N.; Ralph Walter; Francis William John Webb; Lieut. C. D. Webster (Indian Army); Leo Weinthal; Fleetwood H. Williams; Richard Warner Williams; George Benton Wilson; Sidney James Woodhouse; Colonel William Arthur Young (Commanding 2nd Battalion Royal Scots Fusiliers).

HONORARY CORRESPONDING MEMBER.

General Manuel Reyes (President of Colombia).

The Paper read was:—

"Explorations in the Western Himalayas." By Dr. Hunter Workman.

Third Meeting, December 12, 1904.—COLONEL G. E. CHURCH, Vice-President, in the Chair.

ELECTIONS.—*Captain W. J. B. Allen, R.F.A.; Alexander Begg; Captain L. E. Anstey Bennett (Paget's Horse); Frank P. Clark; Rev. W. H. Wurdle Cooper, M.A.; Alexander Frederick Fellowes; Henry Aylmer Humphreys; General Sir Archibald Hunter, K.C.B.; Jules Joseph Georges Lionnet; Edward Lunn; Bertie Pardoe Thomas; David William Middleton Thompson; Maximilian John Ludwick Weston; Charles Wibberley.*

The paper read was:—

"Explorations in Bolivia." By Dr. H. Hoek.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Plant-life. **Schroeter.**
Das Pflanzenleben der Alpen. Eine Schilderung der Hochgebirgsflora. Von Dr. C. Schroeter. Erste Lieferung. Zürich: A. Ranstein, 1904. Size 9½ × 6½, pp. 124. *Maps and Illustrations. Price* 3*s.*

To be completed in four parts. The work will have a distinct bearing on geography, as it discusses the relation of the plant-life to external factors.

Austria—Climatography. **Hann.**
Klimatographie von Österreich. Herausgegeben von der Direktion der K.K. Zentralanstalt für Meteorologie und Geodynamik. I. Klimatographie von Nieder-österreich. Von J. Hann. Wien: W. Braumüller, 1904. Size 11½ × 7½, pp. 104. *Map. Presented by the K.K. Zentralanstalt für Meteorologie.*

This will be noticed elsewhere.

Austria—Herzegovina. *La G.*, *B.S.G. Paris* 10 (1904): 109–114. **Laloy.**
Anthropogéographie de l'Herzégovine. Par Dr. L. Laloy.

Balkan Peninsula. *Mém. S.G. Genève* 43 (1904): 1–93. **Pittard.**
Ethnologie de la Péninsule des Balkans. Par Dr. E. Pittard. *With Plates.*

France—Gascony. *B.G. Hist. et Descriptive* (1904): 96–105. **Saint-Jours.**
Il n'existait pas de baies ouvertes en Gascogne. Les dunes n'empiétaient pas. Par M. Saint-Jours.

France—Landes. *B.S.G. Com. Bordeaux* 30 (1904): 306–312. **Buffault.**
A propos des origines celtiques et phocéennes de la toponymie landaise. Par P. Buffault.

Germany. *J. Manchester G.S.* 19 (1903): 125–150. **Mellor.**
The Wendish Baltic Ports of the Hanseatic League. By E. W. Mellor, J.P. *With Map and Illustrations.*

Germany. ———
Handbuch der Wirtschaftskunde Deutschlands. Herausgegeben im Auftrage des deutschen Verbandes für das Kaufmännische Unterrichtswesen. Vierter Band. Leipzig: B. G. Teubner, 1904. Size 10½ × 7½, pp. vi. and 748. *Map. Price* 18*m. Presented by the Publisher.*

The first three volumes were noticed in the *Journal* for August, 1904, p. 210.

Hungary—Magyars. *Deutsch. Rundschau G.* 26 (1904): 490–494. **Francé.**
Der echte Typus der Magyaren. Von R. H. Francé. *With Illustrations.*

Italy—Bibliography. **Magistris.**
V. Congresso Geografico Italiano. Della necessità di redigere la "Bibliografia Geografica della Regione Italiana" per il Secolo XIX. Relazione di L. F. de Magistris. Size 9½ × 6½, pp. 6. *Presented by Prof. G. Cora.*

Italy—Bolsena. *B.S.G. Italiana* 5 (1904): 407–423. **Palazzo.**
La Stazione Limnologica di Bolsena. Comunicazione del Prof. L. Palazzo. *With Illustrations.*

See note in the October number (p. 476).

Italy—Campania. **Porena.**
Filippo Porena. Campania Felix! Dono del V. Congresso Geografico Italiano. Napoli, 1904. Size 10 × 7, pp. 24. *Map. Presented by Prof. G. Cora.*

Italy—Geographical Manuscripts, etc. **Bertacchi.**
V. Congresso Geografico Italiano. Della Necessità di riprendere e integrare l'elenco iniziale del Narducci sulle opere geografiche manoscritte e sulle più rare a stampa esistenti nelle Biblioteche del Regno. Relazione del Prof. C. Bertacchi. Size 9½ × 6, pp. 6. *Presented by Prof. G. Cora.*

Italy—Sicily—Etna. *Popular Sci. Monthly* 65 (1904): 452-456. **Eastman.**
A Second Century Criticism of Virgil's Etna. By Dr. C. R. Eastman.

Reproduces the passages in which Aulus Gellius records the criticism of Virgil's verses on Etna by the philosopher Favorinus.

Italy—Sicily—Etna. **Platania.**
Su un moto differenziale della spiaggia orientale dell' Etna. Prof. G. Platania. Size 9½ × 6½, pp. 4. *Presented by Prof. G. Cora.*

Italy—Sicily—Rain. **Eredia.**
Sulla distribuzione della pioggia in Sicilia. Nota del Dottor F. Eredia. Size 9½ × 6½, pp. 8. *Presented by Prof. G. Cora.*

Italy—Solfatara. *G. Anzeiger* 5 (1904): 145-150. **Filek.**
Die Solfatara. Eine geographische Studie. Von Dr. E. v. Filek.

Italy—Tuscany. **Hewlett.**
The Road in Tuscany. A Commentary. By M. Hewlett. 2 vols. London: Macmillan & Co., 1904. Size 8 × 5½, pp. (vol. i.) xiv. and 384; (vol. ii.) xiv. and 376. *Illustrations. Price* 21*s. net. Presented by the Publishers.*

This book seems well qualified to be, as its author intends, a companion of Tuscan travel. Arranged somewhat in the fashion of the old road-books, its aim throughout has been to give prominence to the people of the country, as its best product, and themselves the producers of all that is of interest in the way of history, art, and institutions.

Mediterranean. *Petermanns M.* 50 (1904): 174-176. **Fischer.**
Aufgaben und Streitfragen der Länderkunde des Mittelmeergebiets. Von Prof. Dr. T. Fischer.

North Sea—Kattegat. *K. Svensk. Vet.-A. Handl.* 38 (No. 2) (1904): pp. 30. **Cronander.**
Om Ytström och Bottenström i Kattegatt. Af A. W. Cronander.

On the surface and bottom currents in the Kattegat.

Norway—Riings-glacier. *Norske G.S. Aarbog* 14 (1902-3): 119-124. **Reusch.**
Riingsbraeen. Af Dr. Hans Reusch. *Illustrations.*

Cf. note in the November number (p. 595).

Spain. *B.S.G. Lille* 42 (1904): 5-47. **Eustache.**
En Andalousie. Par le Dr. G. Eustache. *With Map and Illustrations.*

Sweden. *K. Svensk. Vet.-A. Handl.* 38 (No. 1) (1904): pp. 94. **Hamberg.**
Die Sommernachtfröste in Schweden, 1871-1900. Von H. E. Hamberg. *With Maps and Diagrams.*

Switzerland—Jura. **Rollier.**
Dr. Louis Rollier, in Verbindung mit Prof. Dr. P. Jaccard u. Prof. Dr. P. Godet. Das Schweizerische Juragebirge. Deutsch von H. Brunner. (Sonderabdruck aus dem "Geographischen Lexikon der Schweiz.") Neuenburg: Gebr. Attinger, 1903. Size 12 × 7½, pp. 40. *Illustrations.*

Switzerland—Lake of Geneva. **Forel.**
Prof. Dr. F. A. Forel. Der Genfersee. Deutsch von H. Brunner. (Sonderabdruck aus dem "Geographischen Lexikon der Schweiz.") Neuenburg: Gebr. Attinger, 1903. Size 11 × 7½, pp. 10. *Map and Illustrations.*

Switzerland—Lucerne Glacier. *J. of T. Victoria I.* 36 (1904): 286-296. **Hull.**
Notes on the Thickness of the Lucerne Glacier of the Post-Pliocene Period. By Prof. E. Hull. *With Plate. Also separate copy, presented by the Author.*

United Kingdom. *J. of T. Victoria I.* 36 (1904): 175-196. **Hull.**
On the Age of the last Uprise of the British Isles. By Prof. E. Hull. *With Map.*

United Kingdom—Bognor. **Morris.**
Bognor as a Health Resort. By Dr. H. C. L. Morris. Bognor: Webster & Webb, 1904. Size 7½ × 5, pp. 32. *Presented by the Author.*

United Kingdom—Coasts. ———
British Association for the Advancement of Science. Southport Meeting, 1903. Report on Observations on Changes in the Sea Coast of the United Kingdom. London: Offices of the Association, 1904. Size 8½ × 5½, pp. 24. *Map.*

The observations so far collected are here tabulated by Mr. J. Parkinson.

United Kingdom—Devon. **Ussher.**

The Geology of the country around Kingsbridge and Salcombe. (Explanation of Sheets 355 and 356.) By W. A. E. Ussher. (Memoirs of the Geological Survey. England and Wales, 355 and 356.) London: E. Stanford, 1904. Size 9½ × 6, pp. 82. *Illustrations. Price* 1*s*. 6*d*.

United Kingdom—Gazetteer. **Bartholomew.**

The Survey Gazetteer of the British Isles, Topographical, Statistical, and Commercial. Compiled from the 1901 census and the latest official returns. Edited by J. G. Bartholomew. With Appendices and Special Maps. London: G. Newnes, 1904. Size 10½ × 7½, pp. 928. *Maps and Plans. Price* (*cloth*) 17*s*. 6*d*. *net; half-morocco*, 21*s*. *net. Two copies, presented by the Editor and Publisher.*

United Kingdom—Lancashire. **Tait.**

Mediæval Manchester and the Beginnings of Lancashire. By J. Tait. Manchester: The University Press; London: Sherratt & Hughes. 1904. Size 9½ × 6, pp. x. and 212. *Frontispiece and Maps. Price* 7*s*. 6*d*. *net. Presented by the Publishers.*

The standpoint in this book is almost purely historical, and there is no attempt to illustrate the influence of geographical factors on the course of the history. The study is, however, of value as the first attempt to discuss in a systematic way the problems connected with the origins of Manchester and the gradual process by which Lancashire attained the position of a recognized administrative county.

United Kingdom—London. **Ordish.**

London Topographical Record, Illustrated, including the Fourth Annual Report of the London Topographical Society. Edited by T. Fairman Ordish. Office of the London Topographical Society, 1903. Size 9 × 6, pp. viii. and 126. *Illustrations. Presented by the London Topographical Society.*

Contains, besides many details on the old topography of London, an article on Norden and his map of 1593.

United Kingdom—London. **Price.**

The Signs of Old Lombard Street. By F. G. Hilton Price. 1887–1902. London: The Leadenhall Press: Simpkin & Co. Size 9 × 6, pp. 208. *Plan and Illustrations. Presented by the London Topographical Society.*

United Kingdom—Scotland. **Watson.**

Place-Names of Ross and Cromarty. By W. J. Watson. Inverness: The Northern Counties Printing and Publishing Co.; London: D. Nutt. 1904. Size 9 × 6, pp. lxxxvi. and 302.

A solid piece of work, based on careful inquiry, especial care having been devoted to the ascertainment of the genuine Gaelic forms of names, by which, the writer claims, the task is raised above the sphere of conjecture, which has caused much work of the kind to lack precision.

United Kingdom—Surrey and Sussex. **Ward.**

Thorough Guide Series. Surrey [south of Epsom] and Sussex [including Tunbridge Wells]. By C. S. Ward. Third Edition—Revised. London: Dulau & Co., 1904. Size 6½ × 4½, pp. xii. and 172. *Maps and Plans. Price* 3*s*. 6*d*. *net. Presented by the Publishers.*

This new edition will be welcomed by the increasing number of Londoners and others who appreciate the scenery of the southern counties.

United Kingdom—Wales. *Geolog. Mag.* 1 (1904): 504–505. **Greenly.**

The Glaciation of Holyhead Mountain. By E. Greenly.

ASIA.

Asia. *Deutsch. Rundschau G.* **26** (1904): 494–512. **Jüttner.**

Fortschritte der geographischen Forschungen und Reisen im Jahre 1903. 2. Asien. Von Dr. J. M. Jüttner.

Central Asia. *Petermanns M.* **50** (1904): 159–170. **Hedin.**

Die wissenschaftlichen Ergebnisse meiner letzten Reise. Von Dr. Sven v. Hedin. *With Map.*

China. *Rev. G.* **28** (1904): 261–269. **Gervais-Courtellemont.**

Exploration du haut Yang-tsé. Par H. Gervais-Courtellemont. *With Map and Illustrations.*

Noticed in the December *Journal* (p. 676).

China and India. *B. l'École Française d'Extrême-Orient* 4 (1904): 131–413. **Pelliot.**
Deux itinéraires de Chine en Inde à la fin du VII[e] Siècle. Par P. Pelliot.

China—Manchuria. **Minocchi.**
Salvatore Minocchi. Per la Manciuria a Pechino. (Ottobre 1903.) Firenze: B. Seeber, 1904. Size 7½ × 5, pp. 360. *Illustrations. Presented by the Publisher.*

Chinese Empire—Mongolia. **Chalon.**
Rev. G. 28 (1904): 99–107, 163–172, 199–206, 227–236.
En Mongolie: le pays des Saïotes. Par P. F. Chalon. *With Map and Illustrations.*

Chinese Empire—Tibet. **Grenard.**
Tibet: the Country and its Inhabitants. By F. Grenard. Translated by A. Teixeira de Mattos. London: Hutchinson & Co., 1904. Size 9 × 6, pp. viii. and 374. *Map. Price* 10*s.* 6*d. net. Presented by the Publishers.*

This English translation of the most generally interesting sections of M. Grenard's important work (noticed in the *Journal* at the time of its appearance) is particularly welcome at the present time. The author has perhaps paid more attention than any recent traveller to the inhabitants of Tibet, their characteristics and social and economic conditions, etc., to which subjects nearly half the book is devoted.

Chinese Empire—Tibet. **Hedin.**
Adventures in Tibet. By Sven Hedin. London: Hurst & Blackett, 1904. Size 9 × 6, pp. xvi. and 488. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

This book, which, though based on Dr. Hedin's larger work, has been entirely re-written for a more popular audience, is not confined to the Tibetan section of the great journey, as might be supposed from the title, but describes the whole of the routes through the Tarim basin, the Gobi, and Tibet. It is likely to find a place in many libraries where considerations of space forbid the inclusion of the two bulky volumes forming the earlier work.

Chinese Empire—Tibet. **Das.**
Sarat Chandra Das. Journeys in Tibet. Translated from the English and edited by V. Kotvich. [In Russian.] St. Petersburg, 1904. Size 8 × 6, pp. xliv. and 356. *Maps and Illustrations.*

Chinese Empire—Tibet. **Wegener.**
Tibet und die englische Expedition. Von Dr. G. Wegener. Halle a. S.: Gebauer-Schwetschke, 1904. Size 9½ × 6½, pp. 148. *Maps and Illustrations. Price* 3*m. Presented by the Publisher.* [See *ante*, p. 85.]

French Indo-China—Tongking. *T. Asiatic S. Japan* 31 (1904): 2–25. **Baelz.**
A Report on a Visit to Tonkin. By Dr. E. Baelz.

India. **Holdich.**
India. By Colonel Sir T. H. Holdich, K.C.M.G., etc. (The Regions of the World). London: H. Frowde, [1904]. Size 9½ × 6½, pp. xii. and 376. *Maps. Price* 7*s.* 6*d. net. Presented by the Publishers.* [To be reviewed.]

India. **Workman.**
Through Town and Jungle. Fourteen Thousand Miles a-wheel among the Temples and People of the Indian Plain. By Dr. W. H. Workman and F. B. Workman. London: T. Fisher Unwin, 1904. Size 10½ × 7, pp. xxiv. and 380. *Map and Illustrations. Price* 21*s. net. Presented by the Publisher.*

The special value of this work consists in the fine series of illustrations of Indian temples and other architectural features.

India. ———
The Imperial Guide to India, including Kashmir, Burma, and Ceylon. London: John Murray, 1904. Size 7½ × 5, pp. xii. and 244. *Maps and Illustrations. Price* 6*s. net. Presented by the Publisher.*

This practical and handy little guide will be a great boon to visitors to India, as it gives in small compass just the sort of information they need in regard to routes, accommodation, and objects of interest.

India. **Soboleff and Gowan.**
J.R. United Service I. 47 (1903): 300, 433, 583, 680, 794; 48 (1904): 75, 170, 255, 395, 541, 687, 817, 938, 1062.
Campaigns against India from the West and through Afghánistán. Translated

and condensed from the Russian of Major-General L. N. Soboleff. By Lieut.-Colonel W. E. Gowan. *With Map.*

India—Burma. *Records Botan. Surv. India* 3 (No. 1) (1904): pp. 142. **Gage.**
The Vegetation of the District of Minbu in Upper Burma. By Captain A. T. Gage. *With Map.* [See *ante*, p. 90.]

India—Survey Report. **Gore.**
General Report on the Operations of the Survey of India administered under the Government of India during 1902-1903. Prepared under the direction of Colonel St. G. C. Gore, C.S.I. Calcutta: 1904. Size 13½ × 8½, pp. iv., 74, and iv. *Frontispiece and Maps. Presented by the Surveyor-General of India.*

Indian Ocean—Andaman Islands. ———
Extracts from Reports and Diaries of two Reconnaissances of the country supposed to be occupied by the Jarawas, 1902. Size 13½ × 8½, pp. 26. *Illustrations. Presented by C. G. Rogers, Esq.*

Japan. **Farrer.**
The Garden of Asia: Impressions from Japan. By R. J. Farrer. London: Methuen & Co., 1904. Size 8 × 5½, pp. xii. and 296. *Price 6s. Presented by the Publishers.*

Not intended as a guide-book, but written with a view to giving a true general picture of a country on which, in the writer's opinion, the ordinary Englishman cherishes ideas "of a conventional and exaggerated futility."

Korea. *B.S.G. Italiana* 5 (1904): 550-574. **Rossetti.**
Impressioni di Corea. Conferenza del C. Rossetti.

Malay Archipelago—Java. **Day.**
The Policy and Administration of the Dutch in Java. By C. Day, PH.D. New York: The Macmillan Co.; London: Macmillan & Co. 1904. Size 8½ × 5½, pp. xxii. and 434. *Price 8s. 6d. net. Presented by the Publishers.*

A study of colonial methods which will be read with much interest in view of existing controversies. The writer holds that the "culture-system" led to abuses as a result of its inherent principles, though he allows that it might have been carried out according to the original plans of Van den Bosch, so as to be a blessing, and not a curse, to the people subject to it.

Malay Archipelago—Timor. **Alderwerelt.**
Tijds. Ind. Taal-, Land- en Volkenk. 47 (1904): 195-226.
Aanteekeningen over Timor en Onderhoorigheden, 1668 tot en met 1809, met eene toelichting van J. de Roo van Alderwerelt.

Malay Peninsula—Historical. *J.R. Asiatic S.* (1904): 719-723. **Gerini.**
Some Unidentified Toponyms in the Travels of Pedro Teixeira and Tavernier. By Colonel G. E. Gerini.

Russia—Caucasia. *Alpine J.* 22 (1904): 197-205. **Wigner.**
In Western Suanetia in 1903. By J. H. Wigner.

Russia—Caucasus. *Le Globe, B.S.G. Genève* 43 (1904): 94-101. **Dingelstedt.**
La Côte orientale de la mer Noire ou la Riviera russe. Par V. Dingelstedt.

Russia—Siberia. **Koulomzine.**
A.-N. de Koulomzine. Le Transsibérien. Traduit du Russe par J. Legras. Paris: Hachette et Cie., 1904. Size 10 × 6½, pp. viii. and 326. *Maps, Diagrams, and Illustrations. Price 5s. 8d.*

A valuable history of the inception and execution of the great Siberian railway project.

Turkey—Asia Minor. *B.S.G. de l'Est* 25 (1904): 5-14. **Gallois.**
Visite aux ruines gréco-romaines d'Asie Mineure. Par E. Gallois.

Turkey—Babylonia. *M.V. Erdk. Leipzig* (1903): 15-20. **Hilprecht.**
Die babylonischen Ausgrabungen der Amerikaner im Bêl-Tempel zu Nippur. Von Prof. Dr. Hilprecht.

AFRICA.

Abyssinia. **Cufino.**
La via da Assab all' Etiopia Centrale pel Golima. L. Cufino. [Napoli, 1904.] Size 9½ × 6½, pp. 6. *Presented by Prof. G. Cora.*

Africa. **Keane.**
Stanford's Compendium of Geography and Travel (New Issue). Africa. Vol. ii. South Africa. By Dr. A. H. Keane. Second Edition. London: E. Stanford, 1904. Size 8 × 5½, pp. xvi. and 672. *Maps and Illustrations. Price* 15*s. Presented by the Publisher.*

Both the text and maps have undergone careful revision in this edition. Good use has evidently been made of the current information supplied by the *Journal*, to which frequent references are made.

Africa—Trade-routes. *Deutsch. Rundschau G.* 27 (1904): 34–35. ——
Verkehrswege in Afrika. *With Map.*

Angola. *B.S.G. Lisboa* 22 (1904): 33–44, 65–77, 126–134. **Carvalho.**
Apontamentos d'uma viagem no sul d'Angola. Por F. C. Dias de Carvalho.

British East Africa—Native tribes. *J. Anthrop. I.* 34 (1904): 130–148. **Tate.**
Notes on the Kikuyu and Kamba tribes of British East Africa. By H. R. Tate. *With Map and Plates.*

Cape Colony. *T.S. African Philosoph. S.* 15 (1904): 61–83. **Rogers and Du Toit.**
The Sutherland Volcanic Pipes and their relationship to other Vents in South Africa. By A. W. Rogers and A. du Toit. *With Plans.*

Cape Colony. *T.S. African Philosoph. S.* 15 (1904): 43–59. **Schwarz.**
High-level Gravels of the Cape and the Problem of the Karroo Gold. By E. H. L. Schwarz. *With Plates.*

Cape Colony. ——
Cape of Good Hope. Department of Agriculture. Annual Report of the Geological Commission, 1903. Cape Town, 1904. Size 10 × 7½, pp. 206. *Maps and Sections.*

Central Africa. *B.S.G. Cher* 2 (1903–1904): 273–288. **Colrat.**
A travers l'Afrique de l'embouchure du Congo au Bahr-el-Ghazal (Mission Bonnel de Mézières): choses et gens de l'Afrique Centrale. Par R. Colrat (compte-rendu par P. Crochet). *With Illustrations.*

Central Africa. **Kandt.**
Caput Nili. Eine empfindsame Reise zu den Quellen des Nils. Von R. Kandt. Berlin: D. Reimer (E. Vohsen), 1904. Size 10 × 7, pp. xvi. and 538. *Maps and Illustrations. Price* 8*m. Presented by the Publisher.*

Central Africa. *Rev. Française* 29 (1904): 489-492. **Pierre.**
De l'Oubangui au Nil. Exploration Charles Pierre.

Central Africa. *Mouvement G.* 21 (1904): 457-460. **Wauters.**
Le grand "Graben" du Tanganyika et du Nil supérieur. Par A. J. Wauters. *With Map and Profile.*

Central Africa—Lake Tanganyika. *J. of T. Victoria I.* 36 (1904): 300–351. **Hudleston.**
On the Origin of the Marine (Halolimnic) Fauna of Lake Tanganyika. By W. H. Hudleston, F.R.S. *With Maps and Sections.*

See note in the Monthly Record, p. 91.

Egypt. *Petermanns M.* 50 (1904): 179–187. **Steindorff.**
Eine archäologische Reise durch die Libysche Wüste zur Amons-Oase Siwe. Von Prof. Dr. G. Steindorff. *With Map.*

The journey was made in 1899–1900 in company with Baron von Grünau (*Journal*, vol. 17, p. 190).

Erythrea and Egyptian Sudan. **Schoenfeld.**
Erythräa und der Ägyptische Sudân. Auf Grund eigener Forschung, an Ort und Stelle dargestellt von Prof. Dr. E. D. Schoenfeld. Berlin: D. Reimer (E. Vohsen), 1904. Size 10 × 7, pp. 246. *Plates. Price* 8*m. Presented by the Publisher.*

Based on the writer's personal observations. The illustrations are unusually good.

French Congo. *Rev. Colon.* (1904): 637–641. **Villelongue.**
De la Sangha à l'Oubangui, par Bayanga, Lopi, la rivière Mokala et Imessé. Itinéraire suivi par M. P. de Villelongue, en Novembre et Décembre, 1902. *Map.*

The Mokala, a western tributary of the Ubangi, approaches within a few miles of the Sangha, and is navigable for canoes throughout.

German South-west Africa. *Deutsch. Kolonialzeitung* 21 (1904): 355–356. **Passarge.**
Das Kaukaufeld, ein Rückzugsgebiet der Herero. Von Dr. S. Passarge.

Ivory Coast. *Rev. Colon.* (1904): 621–636. **Cartron.**
Mission topographique du Sanwi (Côte d'Ivoire). Par M. Cartron.

Kamerun. *Globus* 86 (1904): 149–152. **Hutter.**
Der Elefantensee, ein Urwaldidyll in Nordkamerun. Von Hauptmann a. D. Hutter. *With Illustrations.*

Kamerun. *M.G. Ges. Jena* 22 (1904): 21–24. **Kurge.**
Ein Ausflug ins Land der Banyang.

Kamerun. **Bauer.**
Die Deutsche Niger-Benue-Tsadsee-Expedition 1902–1903. Von F. Bauer. Berlin: D. Reimer (Ernst Vohsen), 1904. Size 10½ × 7, pp. viii. and 182. *Maps and Illustrations. Price 4m. Presented by the Publisher.*

Some account of this expedition was given in the *Journal* for November, 1903 (p. 568).

Kamerun. **Esch, and others.**
Beiträge zur Geologie von Kamerun. Von Dr. E. Esch, Dr. F. Solger, Dr. M. Oppenheim, Prof. Dr. O. Jaekel. Stuttgart: E. Schweizerbart (E. Nägele), 1904. Size 9 × 6½, pp. xiv. and 298. *Maps and Illustrations. Presented by the Kolonial-abteilung des Auswärtigen Amts, Berlin.*

Natal. *Minutes of P.I. Civil Engineers* 157 (1904): 319–329. **Humby.**
Irrigation in the Native Reserves of the Colony of Natal. By A. J. Humby. *With Map and Sections.*

Niger. *G.Z.* 10 (1904): 438–450. **Kleist.**
Die wirtschaftliche Bedeutung des Niger. Von Oberstleutnant a. D. v. Kleist.

Nigeria—Geology. *Geolog. Mag.* 1 (1904): 290–291. **Lelean.**
An Eocene outcrop in Central Africa. By Captain P. S. Lelean. *With Map.*

In a subsequent paper, Dr. F. A. Bather describes the Eocene echinoids brought by Captain Lelean from Sokoto. (Cf. *Journal* for November, p. 522.)

Nile. *Scottish G. Mag.* 20 (1904): 474–489, 543–544. **Waite.**
The Annual Rise and Fall of the Nile. By P. C. Waite. *With Diagrams.*

Portuguese Guinea. *Deutsch. Rundschau G.* 27 (1904): 5–13. **Wagner.**
Portugiesisch-Guinea. Land und Leute. Von R. Wagner. *With Map and Illustrations.*

Sahara—Geology. **Besset and Flamand.**
Renseign. Colon., Comité l'Afrique Française (1904): 1–15, 62–68.
D'In-Salah à Amguid. Par Lieut. Besset and G. B. M. Flamand. *With Map and Illustrations.*

Sahara and Sudan. **Leroy-Beaulieu.**
Le Sahara, le Soudan et les Chemins de fer Transsahariens. Par P. Leroy-Beaulieu. Paris: Guillaumin et Cie., 1904. Size 9 × 6, pp. xiv. and 494. *Map. Price 8 fr.*

The author, who has long been known as one of the most vigorous champions of railway communication across the Sahara, here gives a valuable summary and discussion of the whole subject, with copious information on the course of exploration and the nature of the Sahara.

Sahara—Telegraph. *Renseign. Colon., Comité l'Afrique Française* (1904): 185–194. **Nou.**
Le Transsaharien télégraphique. Par Capitaine Nou. *With Map.*

Sahara—Tuat. **Niéger.**
Renseign. Colon., Comité l'Afrique Française (1904): 170–177, 195–203.
Le Touat. Par Lieutenant Niéger.

South Africa. **Theal.**
History of South Africa from 1795 to 1828. Ditto, from 1828 to 1846, and from 1846 to 1860. By G. McCall Theal. London: Sonnenschein & Co., 1903–4. 3

vols. Size 9 × 6, pp. xviii. and 480, xiii. and 504, xiv. and 478. *Maps. Price 7s. 6d. each vol. Presented by the Publishers.*

Part of a new edition of Dr. Theal's great work, with considerable additions, brought out at a price which will put it within the reach of a wide circle of readers. The vols. are not numbered, and a separate title is given to each, but the chapters run consecutively throughout.

South Africa—Kalahari. **Passarge.**

Die Kalahari, Versuch einer physisch-geographischen Darstellung der Sandfelder des südafrikanischen Beckens. Von Dr. S. Passarge. Herausgegeben mit Unterstützung der Königlich Preussischen Akademie der Wissenschaften. Text, and Maps (separate). Berlin: D. Reimer (Ernst Vohsen), 1904. Size 11½ × 8, pp. xvi. and 822. *Illustrations. Price 80m. Presented by the Publisher.* [To be reviewed.]

Transvaal. ——

Geological Survey of the Transvaal. Report for the year 1903. Pretoria, 1904. Size 13½ × 8½, pp. 48. *Maps and Illustrations. Price 7s. 6d. Presented by the Secretary of State for the Colonies.*

Uganda. ——

Africa. No. 12 (1904). General Report on the Uganda Protectorate for the year ending March 31, 1904. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. 40. *Price 4½d.* [See *ante*, p. 92.]

Victoria Nyanza. **Lyons.**

On the Variations of Level of Lake Victoria. By Captain H. G. Lyons. Being Appendix III. of a Report upon the Basin of the Upper Nile, with proposals for the improvement of that river. By Sir W. Garstin, G.C.M.G. Cairo, 1904. Size 13½ × 9, pp. 20. *Diagram.*

Wadai. **Julien.**

Renseign. Colon., Comité l'Afrique Française (1904): 51–62, 87–92, 108–110, 138–143.

Le Dar-Ouadaï. Par Capitaine Julien.

West Africa. *Globus* **86** (1904): 157. ——

Die Arbeiten der Jola—Tschadsee Grenz-expedition.

NORTH AMERICA.

Alaska. *J. Franklin I.* **158** (1904): 289–310, 353–366. **Abercrombie.**

The Copper River Country, Alaska. By Major W. R. Abercrombie. *With Map and Illustrations.*

Alaska. *B.U.S. Geolog. Surv.*, No. **229** (1904): pp. 62. **Collier.**

The Tin Deposits of the York region, Alaska. By A. J. Collier. *With Maps and Illustrations.*

Canada. **Buron.**

E. J. P. Buron. Les richesses du Canada, Préface de G. Hanotaux. Paris: E. Guilmoto, [*not dated*]. Size 9 × 6, pp. xiv. and 368. *Map. Price 7 fr.* 50.

A careful study of the economic resources of Canada.

Canada—Historical. *T.R.S. Canada* **9** (Sec. II.) (1903): 15–28. **Burpee.**

The Lake of the Woods Tragedy. By L. J. Burpee. *With Map.*

Brings together all the available evidence regarding the massacre of a French party by the Sioux on the Lake of the Woods in 1736.

Canada—New Brunswick. **Ganong.**

B. Nat. Hist. S. New Brunswick **5** (1904): 179–241.

Notes on the Natural History and Physiography of New Brunswick. By W. F. Ganong. *With Maps and Illustrations.*

This instalment includes papers on the geological history of certain rivers, on the highest land in New Brunswick, etc.

Canada—Rupert's Land. *T.R.S. Canada* **9** (Sec. II.) (1903): 135–144. **Bryce.**

Intrusive Ethnological Types in Rupert's Land. By Rev. Dr. G. Bryce.

Mexico. **Bonaparte and others.**

Le Mexique au début du XX^e Siècle. Par MM. le Prince R. Bonaparte, L. Bourgeois, J. Claretie, d'Estournelles de Constant, A. de Foville, H. Gomot, O. Gréard,

A. Haller, O. Krantz, M. Lagrave, L. de Launay, P. Leroy-Beaulieu, E. Levasseur, le général Niox, A. Picard, E. Reclus. 2 vols. Paris: C. Delagrave, [1904]. Size 12 × 8, pp. (vol. i.) 394; (vol. ii.) 374. *Maps. Presented by the Publisher.*

The most complete and systematic description of Mexico and its people that has yet appeared.

Mexico. **Biorklund.**

Live-Stock in Mexico. Foreign Office, Miscellaneous, No. 614, 1904. Size 10 × 6½, pp. 42. *Price* 2½*d.*

North America—Early Travel. **Hennepin and Thwaites.**

A New Discovery of a Vast Country in America. By Father Louis Hennepin. Reprinted from the second London issue of 1698, with facsimiles of original title-pages, maps, and illustrations, and the addition of Introduction, Notes, and Index. By R. G. Thwaites. 2 vols. Chicago: A. C. McClurg & Co., 1903. Size 8½ × 6½, pp. lxiv. and 712. *Price* $6.00 *net.*

An excellent reprint of this famous old work.

United States. **Colquhoun.**

Greater America. By A. R. Colquhoun. London and New York: Harper & Brothers, 1904. Size 9 × 6, pp. x. and 436. *Portrait and Maps. Price* 16*s. Presented by the Publishers.* [Reviewed *ante*, p. 88.]

United States—Economic Geology. **Emmont, Hayes, and others.**

B. United States Geolog. Surv., No. 225 (1904): pp. 528.

Contributions to Economic Geology, 1903. *With Maps, Plans, etc.*

United States—Geological Survey. ——

B. United States Geolog. Surv., No. 227 (1904): pp. 206.

The United States Geological Survey, its Origin, Development, Organization, and Operations. *With Maps and Illustrations.*

United States—Gypsum. **Adams and others.**

B. United States Geolog. Surv., No. 223 (1904): pp. 130.

Gypsum Deposits in the United States. By G. I. Adams and others. *With Maps and Illustrations.*

United States—Historical. **Chittenden.**

History of Early Steamboat Navigation on the Missouri River. Life and Adventures of Joseph La Barge. By H. M. Chittenden. 2 vols. New York: F. P. Harper, 1903. Size 9½ × 6½, pp. xiv. and 462. *Maps and Illustrations. Price* 25*s.*

An attempt to weave the story of steamboat navigation on the Missouri, one of the most important factors in the opening up and development of the west, around the biography of its most distinguished personality, whose memoirs were personally dictated to the author only some half-dozen years ago.

United States—Mississippi. *T.R.S. Canada* **9** (Sec. I.) (1903): 3–44. **Sulte.**

Découverte du Mississipi en 1659. Par B. Sulte.

Refers to the journeys of Chouart and Radisson, the latter of whom M. Sulte considers to have reached the true Mississippi, though this is generally considered doubtful.

United States—Mississippi River. *P. American Philosoph. S.* **43** (1904): 71–96. **Haupt.**

The Mississippi River Problem. By L. M. Haupt. *With Map.*

On methods of controlling floods.

United States—Nevada and California. **Spurr.**

B. United States Geolog. Surv., No. 208 (1903): pp. 230.

Descriptive Geology of Nevada south of the Fortieth Parallel and adjacent portions of California. By J. E. Spurr. *With Maps and Illustrations.*

United States—New York—Hudson River. **Davis.**

B. American G.S. **36** (1904): 557–559.

The Hudson River described by W. M. Davis.

United States—Ohio. **Flynn.**

The Natural Features and Economic Development of the Sandusky, Maumee, Muskingum, and Miami Drainage Areas in Ohio. By B. H. Flynn and M. S. Flynn. (United States Geological Survey, Water-Supply and Irrigation Paper No. 91.) Washington, 1904. Size 9½ × 6, pp. 130. *Maps and Diagrams. Presented by the U.S. Geological Survey.*

United States—South Dakota. **Todd and Hall.**
Geology and Water Resources of part of the Lower James River Valley, South Dakota. By J. E. Todd and C. M. Hall. (United States Geological Survey, Water-Supply and Irrigation Paper No. 90.) Washington, 1904. Size 9¼ × 6, pp. 48. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Texas. **Gannett.**
B. United States Geolog. Surv., No. 224 (1904): pp. 178.
A Gazetteer of Texas (Second Edition). By H. Gannett. *With Maps.*
Contains a valuable introductory sketch.

United States—Virginia. **Eckenrode.**
The Political History of Virginia during the Reconstruction. By H. J. Eckenrode. (Johns Hopkins University Studies, Series xxii., Nos. 6–7–8.) Baltimore, 1904. Size 9½ × 6, pp. 128 and 70.

CENTRAL AND SOUTH AMERICA.

Andes. *Globus* 86 (1904): 91–93. **Goll.**
Das Leuchten der Vulkane in den Südamerikanischen Anden. Von Dr. F. Goll.
On a phenomenon presenting the appearance of lightning.

Bolivia. **Armentia.**
Lenguas Americanas (Sección Bolivia). Los Indios Mosetenes y su lengua. Noticias generales y vocabularios por el P. Fr. N. Armentia. Con introducción de S. A. Lafone Quevedo. Buenos Aires, 1903. Size 10½ × 7, pp. 126. *Presented by Sr. S. A. Lafone Quevedo.*
Reprinted from the *Anales de la Soc. Cientifica Argentina.*

Bolivia. **Calderón.**
Abdón Calderón. Indice sinoptico de Leyes, Decretos, Resoluciones y Ordenes administrativas dictadas desde 1825 hasta 1900 inclusive en el ramo de Hacienda é Industria. La Paz, 1904. Size 9½ × 7, pp. 380.

Bolivia. *Petermanns M.* 50 (1904): 188–195. **Jerrmann.**
Reise in die Gummidistrikte Ost-Boliviens. Von Hpt. Jerrmann. *With Map.*

Central and South America. ———
Monthly B. Internat. Bureau American Reps. 17 (1904): 138–205.
Latin America in 1903—A Review.

Chile and Argentina. **Holdich**
The Countries of the King's Award. By Col. Sir T. H. Holdich. London: Hurst & Blackett, 1904. Size 9 × 5½, pp. xvi. and 420. *Map and Illustrations. Price* 16*s. net. Presented by the Author.* [To be reviewed.]

Ecuador. *M.V. Erdk. Leipzig* (1903): 36–39. **Meyer.**
Reise im Hochland von Ecuador. Von Prof. Dr. H. Meyer.

Falkland Islands. **Vallentin.**
Mem. Manchester Lit. and Philosoph. S. 48 (No. 23) (1903-1904): pp. 48.
Notes on the Falkland Islands. By R. Vallentin. *With Plates.*
Deals chiefly with the natural history of the group (see *ante*, p. 96).

Guadeloupe. *B. American G.S.* 36 (1904): 513–530. **Hovey.**
The Grande Soufrière of Guadeloupe. By E. O. Hovey. *With Map and Illustrations.*

Honduras. **Moe.**
Honduras: Geographical Sketch, Natural Resources, Laws, Economic Conditions, Actual Development, Prospects of Future Growth. Edited and compiled for the International Bureau of the American Republics by A. K. Moe. 1904. Washington, 1904. Size 9 × 6, pp. 252. *Maps and Illustrations. Presented by the Bureau.*

Paraguay. *Deutsch. Rundschau G.* 27 (1904): 23–31. **Fischer-Treuenfeld.**
Kolonie Hohenau in Paraguay. Von R. von Fischer-Treuenfeld.

Peru. *National G. Mag.* 15 (1904): 311–323. **Calderon.**
Peru—Its Resources, Development, and Future. By A. A. Calderon.

Venezuela. *M.V. Erdk. Leipzig* (1903): 33-36. **Passarge.**
Reise im Gebiet des Orinoko. Von Dr. S. Passarge.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Ethnology. **Howitt.**
The Native Tribes of South-East Australia. By A. W. Howitt, D.SC. London: Macmillan & Co., 1904. Size 9 × 6, pp. xx. and 820. *Maps and Illustrations. Price 21s. net. Presented by the Publishers.*

Hawaii. *Deutsch. Rundschau G.* **27** (1904): 1-5. **Kuntze.**
Der Kilauea auf Hawaii als Vulkan erloschen. Von Dr. O. Kuntze.

New Zealand. *J. of T. Victoria I.* **36** (1904): 129-147. **Boord.**
On the Hot Lakes District, New Zealand. By Miss Hilda Boord. *With Illustration.*

Pacific Ocean. *B. American G.S.* **36** (1904): 530-534. **Littlehales.**
The Disproof of the Existence of Reed or Redfield Rocks. By G. W. Littlehales. *With Chart.*

These rocks were supposed to exist some 700 miles west of San Francisco.

Queensland. ——
Queensland. Report of the Government Statistician on Agricultural and Pastoral Statistics for 1903. [Brisbane], 1904. Size 13½ × 8½, pp. 68. *Presented by the Government Statistician of Queensland.*

Queensland—Torres Strait. *Globus* **86** (1904): 177-181. ——
Die Bewohner der westlichen Torresstrasse-Inseln. *With Illustrations.*

POLAR REGIONS.

Antarctic—German Expedition. **Drygalski.**
Zum Kontinent des eisigen Südens. Von Erich von Drygalski. Deutsche Südpolarexpedition, Fahrten und Forschungen des *Gauss* 1901-1903. Berlin: G. Reimer, 1904. Size 11 × 8, pp. xiv. and 668. *Maps and Illustrations. Price 18m. Presented by the Publisher.* [To be reviewed.]

Antarctic—Swedish Expedition. **Nordenskjöld and others.**
"Antarctic." Zwei Jahre in Schnee und Eis am Südpol. Von Dr. O. Nordenskjöld, J. G. Andersson, C. A. Larsen, und C. Skottsberg. Nach dem schwedischen Original ins deutsche uebertragen von M. Mann. 2 vols. Berlin: D. Reimer (E. Vohsen), 1904. Size 6½ × 7, pp. (vol. i.) xxiv. and 374; (vol. ii.) vi. and 408. *Maps and Illustrations. Price 12m. Presented by the Publisher.* [To be reviewed.]

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. **Suess.**
The Face of the Earth (Das Antlitz der Erde). By E. Suess. Translated by H. B. C. Sollas, under the direction of W. J. Sollas. Vol. i. Oxford: The Clarendon Press, 1904. Size 10 × 7, pp. xii. and 604. *Maps and Illustrations. Price 25s. net. Presented by the Publishers.* [To be reviewed.]

Physical Geography. **Brigham.**
Twentieth Century Text-Books. Students' Laboratory Manual of Physical Geography. By Prof. A. P. Brigham. New York: D. Appleton & Co., 1905 [1904]. Size 8 × 5½, pp. vi. and 154. *Maps and Illustrations. Presented by the Publishers.*

Forms a valuable supplement to the 'Introduction to Physical Geography,' which appeared in 1902. It will aid both teacher and student in the prosecution of the practical work, which is of so much importance, but has been far too much neglected in the past.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Economic Geography. **Friedrich.**
Allgemeine und Spezielle Wirtschaftsgeographie. Von Dr. E. Friedrich. Leipzig: G. J. Göschen, 1904. Size 9 × 6, pp. 370. *Maps. Presented by the Publisher.*

Reviewed in the November number, p. 581.

Economic Geography. **Oppel.**
Natur und Arbeit. Eine allgemeine Wirtschaftskunde von Prof. Dr. A. Oppel. 2 vols. Leipzig und Wien: Bibliographisches Institut, 1904. Size 10½ × 7, pp. (vol. i.) x. and 352; (vol. ii.) x. and 458. *Maps and Illustrations. Price (each vol.)* 10*s.*

An important work on the physical bases of human industries.

Historical—Cartography. **Porena.**
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Paper read at the Fifth Italian Geographical Congress.

Mankind. *G.Z.* 10 (1904): 417-438. **Chalikiopoulos.**
Geographische Beiträge zur Entstehung des Menschen und seiner Kultur. Von Dr. L. Chalikiopoulos.

Settlements. *G. Anzeiger* 5 (1904): 121-123. **Fischer.**
Die Siedelungsgeographie, das natürliche Arbeitsfeld unserer germanistisch-historisch gebildeten Erdkundelehrer, im Anschluss an Otto Schlüter "Die Siedelungen im nordöstlichen Thüringen." Von H. Fischer.

GENERAL.

America and Africa. *Deutsch. Rundschau G.* 26 (1904): 534-558. **Jüttner and Umlauft.**
Fortschritte der geographischen Forschungen und Reisen im Jahre 1903. 3. Amerika. Von Dr. J. M. Jüttner. 4. Afrika. Von Dr. F. Umlauft.

British Empire. **George.**
A Historical Geography of the British Empire. By H. B. George. London: Methuen & Co., 1904. Size 8 × 5½, pp. xii. and 312. *Map. Price* 3*s.* 6*d. Presented by the Publishers.* [To be reviewed.]

Educational—Orientation. *G. Anzeiger* 5 (1904): 171-175. **Geissler.**
Osten und Westen. Von Dr. K. Geissler.

Exploration. **Williams.**
The Romance of Modern Exploration, with descriptions of curious customs, thrilling adventures, and interesting discoveries of explorers in all parts of the world. By A. Williams. London: Seeley & Co., 1905 [1904]. Size 8 × 5½, pp. 384. *Illustrations. Price* 5*s. Presented by the Publishers.*

This does not profess to give a complete history, even of the most notable exploring work in modern times, but is rather a collection of striking episodes in that history. The writer has studied the original authorities with evident care, and his facts are therefore more accurate than is often the case in popular works of the kind.

Italian Geographical Society. **Dalla Vedova.**
Prof. G. Dalla Vedova. La Societa Geografica Italiana e l'opera sua nel secolo XIX. Roma, 1904. Size 10 × 6½, pp. 92. *Illustrations. Presented by Prof. G. Dalla Vedova.*

Medical Geography—Sleeping Sickness. **Lankester.**
Quarterly Rev. 200 (1904): 113-138.
The Sleeping Sickness. By E. Ray Lankester, F.R.S. *With Illustrations.*

Travel. **Pinnock.**
Wander-Years Round the World. By J. Pinnock. London: T. Fisher Unwin, 1904. Size 9½ × 6, pp. xvi. and 350. *Maps and Illustrations. Price* 21*s. net. Presented by the Publisher.*

A popular work descriptive of Travel in the West Indies, Mexico, the Western United States, Hawaii, Japan, China, Australasia, Ceylon, India, and British East Africa. The writer has naturally nothing very new to say, but the book may be appreciated by those who desire information on these countries in not too serious a form. It is well illustrated by photographs and maps.

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Chinese Empire. **Johnston.**

Chinese Empire. Scale 1 : 3,041,000 or 48 stat. miles to an inch. Constructed and drawn by W. & A. K. Johnston, Ltd. 4 sheets. Edinburgh and London: W. & A. K. Johnston, Ltd. *Presented by the Publishers.*

This is a highly-coloured general map of the Chinese Empire in four sheets. It is boldly executed, and when the sheets are joined in one and mounted on rollers, it will be useful as a wall map for reference in office or library. Free ports and mission stations are clearly indicated; railways in operation and under construction are shown. As regards the latter, however, there is no indication of the Hankau to Canton line, and the line to Kirin is shown as open, which is not the case.

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A useful general map of the Congo Free State, on one sheet, compiled from the latest information, and printed in colours.

Egypt. **Survey Department, Cairo.**

Topographical Map of Giza Province. Scale 1 : 10,000 or 6·3 inches to a mile. Sheets: S.E., Nos. 16–5, 16–6, 17–5, 17–6, 18–4, 19–5, 20–5, 21–5. Cairo: Survey Department, Public Works Ministry, 1904. *Presented by the Director-General, Survey Department, Cairo.*

South Africa. **Johnston.**

Commercial Map of South Africa. Scale 1 : 1,267,000 or 20 stat. miles to an inch. 4 sheets. Edinburgh and London: W. & A. K. Johnston, Ltd. *Presented by the Publishers.*

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South Africa. **"South Africa."**

The Railway Map of South Africa. Scale 1 : 4,000,000 or 63 stat. miles to an inch. Revised to date and published by authority at the offices of "South Africa," Winchester House, London, 1905. *Presented by the Publishers.*

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheet No. xliii., Sidi Nasseur Allah. Paris: Service Géographique de l'Armée, [1904]. *Price 1.50f. each sheet.*

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United States, including Territories and Insular Possessions, showing the extent of the Public Surveys, Indian, Military and Forest Reservations, Railroads, Canals, National Parks, and other details. Scale 1 : 2,344,320 or 37 stat. miles to an inch. Compiled under the direction of Frank Bond, and corrected to June 30, 1903. Washington, D.C.: Department of the Interior, General Land Office: William A. Richards, Commissioner.

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Parts 18 and 19. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50 pf. each part.*

These two parts contain the following maps: No. 5, The World in Hemispheres; No. 56, Holland, Belgium, and Luxemburg; No. 59, Denmark and Iceland; No. 73, Asiatic Russia; No. 74, Japan; No. 78, Indo-China; No. 84, Western Sudan; No. 85, Eastern Sudan.

World. **Petrie and Schokalsky.**

Marcks' Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Part 10. St. Petersburg: A. F. Marcks, 1904. [In Russian.] *Presented by the Publisher.*

This part contains plates: No. 30, Sheet 16*a* of a map of European Russia, on the scale of 1 : 2,000,000; No. 34, map of Elsass-Lothringen and North-East France, on the scale of 1 : 1,000,000; No. 37, map of Austria-Hungary, on the scale of 1 : 2,750,000; No. 42, map of Spain and Portugal, on the scale of 1 : 2,750,000.

World. **Schrader.**

L'Année Cartographique. Supplément annuel á toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Quatorzième année contient les modifications géographiques et politiques des années 1903–1904. Paris: Hachette et Cie., 1904. *Price 3f.*

M. Schrader's useful publication, 'l'Année Cartographique,' has now reached its

fourteenth year of issue. In its general design and arrangement the present number is similar to the previous ones, and contains a brief account of the more important geographical changes that have taken place in the world during the years 1903-1904. There are three sheets, one devoted to Asia, another to Africa, and the third to America. Each of the sheets contains several maps with descriptive letterpress on the back. The sheet devoted to Asia contains the following maps: Asia, showing railway development; Lieut. G. Grillières and M. Gervais Courtellemont's journeys in Yunnan and the bend of the Yang-tse Kiang; and Dr. Karl Futterer's work in North-Eastern Tibet. The African sheet contains a map of the Northern Sahara from recent explorations; M. Chevalier and Captain Lenfant's explorations in the Lake Chad region and the Cameroons; a map of Southern Ethiopia, showing the journeys and explorations of Baron von Erlanger, Count Wickenburg, and Mr. A. F. Butter; and a small general sketch of French West Africa, showing the new administrative divisions. The sheet dealing with America contains altogether five maps: the new frontier between Brazil and Bolivia; the recent Arctic explorations of Commander Peary and Mr. D. T. Hanbury; routes of Créqui Montfort ond Sénéchal de la Grange in the Argentine Republic and Bolivia; and the new Alaska-British Columbia boundary. It will thus be seen that a great deal of ground is covered in the three sheets, and the summaries given must necessarily be brief. It is, however, somewhat surprising to find no mention of the Antarctic regions, especially as so much attention has been paid to that part of the world lately.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich herausgegeben von Justus Perthes' Geographischer Austalt. 37 and 38 Lieferung. Gotha: Justus Perthes. *Price* 60 *pf. each part.*

These two parts are in one cover, and contain the following maps: No. 50, Balkan Peninsula, on the scale of 1 : 3,700,000, by B. Domann; No. 59, Asia Minor, Syria, etc, on the scale of 1 : 3,700,000, by H. Habenicht; Nos. 99 and 100, Sheets 5 and 6 of a map of South America, on the scale of 1 : 7,500,000, by H. Habenicht.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during September and October, 1904. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
×	0·15	Diagram to facilitate the obtaining a ship's position by Sumner's method. 6*d*.
3239 } 3250 }		Monthly wind-charts for the South Atlantic ocean. 6*d*. *each*. The same twelve charts bound together in an Atlas. 7*s*.
3427 m	= 2·5	France, north coast:—Rade de Brest. 2*s*. 6*d*.
3383 m	= 2·4	Nova Scotia:—The Gut of Canso. 2*s*. 6*d*.
3450 m	= 5·0	West Indies. Cuba, south coast:—Ensenada de Mora. 1*s*. 6*d*.
3454 m	= var.	Central America:—Plans of anchorages on the north coast of Panama 1*s*. 6*d*.
3447 m	= 2·98	British Columbia. Vancouver island, east coast:—Moresby passage with its approaches. 1*s*. 6*d*.
3448 m	= 11·8	North America, west coast. Queen Charlotte sound:—Blunden harbour. 1*s*. 6*d*.
3430 m	= 1·99	North America. Vancouver's island:—Galetas and New channels. 2*s*. 6*d*.
3443 m	= {1·99, 2·97}	North America. Vancouver's island:—Nawhitti bar, Bull harbour. 2*s*. 6*d*.
3452 m	= 5·0	Persian gulf entrance:—Khor Kawi anchorage. 1*s*. 6*d*.
3456 m	= 2·6	Bay of Bengal, east coast:—Cox's Bazar. 1*s*. 6*d*.
3453 m	= 1·55	Malacca strait:—Klang strait and approaches. 2*s*. 6*d*.
3368 m	= 0·72	Philippine islands. South part of Luzon island:—Batan I. to San Bernardino I., and Himagaan bay to Inamok. 2*s*. 6*d*.
3459 m	= 5·89	China, south-east coast. Hong hai bay:—Sam chau inlet. 1*s*. 6*d*.
139 m	= 1·9	Japan. Ikitsuki jima to Taka shima, including the northern approaches to Hirado kaikyo. 2*s*. 6*d*.
3438 m	= 0·34	Japan:—O shima to Furubira wan. 2*s*. 6*d*.
3409 m	= 0·17	Japan. Ishinomaki wan (Sendai bay) and Sakata ko to Tsugaru kaikyo (strait). 2*s*. 6*d*.

3489 m = 1·0 Solomon islands, Ysabel:—Austria sound (Plan:—Allardyce harbour). 1s. 6d.

3445 m = 0·5 Pacific ocean. Loyalty islands:—Uvea atoll and Beautemps-Beaupré island. 1s. 6d.

1751 Rio de la Plata. Saucé point to Martin Garcia island. Plan added:—Saucé harbour.

1881 Indian ocean. Cargados Carajos islands. Plan added:—Agalega islands.

3031 Bays and anchorages on the east coast of Borneo. New plan:—Buja and Manimbora anchorages.

1384 Pacific ocean. Loyalty islands, anchorages in. Plan added:—Dokin bay, Gaatcha bay, Ro bay, Poane bay, Aui bay.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
×0·15	Diagram to facilitate the obtaining a ship's position by Sumner's method	New diagram	×0·15
1493	Port Chagres.	New sheet of plans, including Port Chagres	3454
571	Blunden harbour. Plan on this sheet	New plan. Blunden harbour	3448
555	Goletas channel, etc.	New plans. Goletas and New channels	3430
2067	Bull harbour. Plan on this sheet	New plan on sheet	3443
2595	Port Sorsogon. Plan on this sheet	New chart. Batan island to S. Bernardino island, etc.	3368
139	Northern entrance to Hirado-no-seto, etc.	New plan. Ikitsuki jima to Taka shima, etc. . .	139
3199	Allardyce harbour. Plan on this sheet.	New plan on chart	3439
1384	Uvea bay. Plan on this sheet.	New plan. Uvea atoll and Beautemps-Beaupré island	3445

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1188, The World:—Coal and telegraph chart. 2218, England, south coast:—Teignmouth. 1776, Færoe islands:—Tranjisvaag. 3159, Norway:—Torbiornskier to Jœlöen. 3160, Norway:—Torbiornskier to Rauö. 2300, Baltic. Gulf of Bothnia:—Sheet V.: Stiernö point to Fiäderag, etc. 2302, Baltic sea. Sheet VII.: Tome point round the head of the gulf to Tauvö. 3345, France, west coast:—Chenal du Four. 274, North Polar chart:—Atlantic side. 278, North Polar chart:—Pacific side. 2740, Iceland and the Færoe islands. 2976, Iceland:—Snefells Jökel to North cape. 2977, Iceland:—North cape to Sigle fiord. 275, America, north coast:—Smith sound, Kennedy and Robeson channels. 2564, United States America, east coast:—Delaware river (Sheet 2). 528, South America. Sheet IV.: Maranham to Pernambuco. 1911, United States, west coast:—Approach to Juan de Fuca strait. 2908, Africa, south coast:—Port Natal entrance. 2757, Banka strait to Singapore. 941*a*, Eastern archipelago, western portion. 941*b*, Eastern archipelago, western portion. 2637, Celebes:—Strait of Makassar, south part. 1466, China, east coast:—Hongkong, Fotaumun pass. 2409, West coast of Formosa and Pescadores channel. 913, Korea, west coast:—Mackau group to Clifford islands. 104, Korean archipelago, southern portion. 3365, Korea south-west coast:—Port Hamilton to Mackau group. 980, Caroline islands.

(*J. D. Potter, Agent.*)

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Charts. Nos.: 94, Puerto Condor i Bahia Sholl; 95, Canales de entrada de la Bahia Jente Grande i Bahia Jente Grande; 102, Bahia Tic-toc i Puertos Auchemo i Yelcho; 103, Estuario i Canal Baker; 104, Canal Messier, Puertos en el Estuario Baker; 105, Puerto Zapallar i Bahia de Papudo; 114, Bahia de Quintero. Valparaiso: Oficina Hidrografica, Marine de Chile, 1903–4. *Presented by the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for December, 1904. London: Meteorological Office, 1904. *Price 6d. Presented by the Meteorological Office, London.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for December, 1904. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

South Atlantic. **Meteorological Office.**

Monthly Wind-Charts of the South Atlantic Ocean. London: Hydrographic Office, 1904. *Price 7s. Presented by the Meteorological Office.*

This atlas consists of a series of twelve wind-charts—one for each month—of the South Atlantic ocean, with the eastern part of the South Pacific ocean which have been prepared by the Marine Branch of the Meteorological Office. Lines of equal barometric pressure and air-temperature are drawn from observations made simultaneously with those of the wind. The data from which the charts have been drawn consists of records obtained from nearly 3300 logs kept for the office by voluntary observers in the Royal Navy and the Mercantile Marine, supplemented by information obtained from about 1000 logs of H.M. ships, lent by the Admiralty for the purpose. A table of the mean rainfall for each month for twenty-four stations is given with other information at the commencement of the Atlas.

PHOTOGRAPHS.

British East Africa. **Brooke.**

Thirteen photographs of British East Africa, taken by J. W. Brooke, Esq. *Presented by J. W. Brooke, Esq.*

These little kodak photographs were taken by Mr. Brooke during a journey he made through the region to the north of Mount Elgon and Lake Rudolf in the years 1903–4.

(1) A volcanic bubble near Nakuro station; (2) Basalt cliffs south of Lake Naivasha; (3) The Naivasha zebra farm; (4) A pair of sixty-pound tusks, Naivasha; (5) Masai headdress of small bird-skins; (6) A donkey bogged; (7) Bush on the foot-hills of Elgon; (8) Karamoja tribe; (9) Crossing the Kabush, southern Abyssinia; (10) A camp on Lake Rudolf; (11) A Turkhana bull, Lake Rudolf; (12) My first elephant; (13) Our fighting force.

California. **Stark.**

Twenty photographs of the Yosemite Valley, California, taken by W. Emery Stark, Esq. *Presented by W. Emery Stark, Esq.*

The beautiful scenery of the Yosemite valley is well known, and has often been photographed. These views are decidedly typical, and form a welcome addition to our collection.

(1–4) Views in the Yosemite valley; (5) Village in the Yosemite valley; (6) The Bridal falls; (7 and 8) The Nevada falls; (9) Distant view of the Nevada and Vernal falls; (10) General view from Glacier point; (11 to 13) The Mirror lake; (14 and 15) The Merced river; (16) The Yosemite valley; (17) View from Inspiration point; (18 and 19) The Wawona forest; (20) Our mountain cavalcade.

Fiji and Samoa Islands. **Stark.**

Fifty-five photographs of the Fiji and Samoa islands, taken by W. Emery Stark, Esq. *Presented by W. Emery Stark, Esq.*

A set of quarter-plate platinotypes, illustrating scenes of life in Samoa and Fiji at the present time. They were taken upon the occasion of Mr. W. Emery Stark's visit to the islands in May and June, 1903.

(1 and 2) Suva; (3) A street in Suva; (4) The "town clock," a log of wood struck with a mallet, Suva; (5–7) Levuka; (8) Rewa; (9) The chief of Rewa in front of the royal hut; (10) Coming out of church, Rewa; (11) The chief of Rewa; (12 and 13) Bread-fruit trees on the Rewa property; (14) The family and councillors of the chief of Rewa; (15) An old cannibal, a relic of the past; (16–18) Apia; (19) A scene in Apia; (20 and 21) The beach, Apia; (22 and 23) Scene near Apia; (24) The Court of Justice, Apia; (25) A double war-canoe, Apia; (26) Native policemen, Apia; (27) The chief justice (native) of Samoa; (28) A mission school, Apia; (29) Coming out of church on Sunday, Apia; (30) Natives in their Sunday best, Apia; (31) Cocoa-nut palms, Apia; (32) An avenue of palms, Samoa: (33) A chieftess; (34) A chieftess and baby; (35) Making baskets of palm-leaves; (36 and 37)

Hut building; (38) A native hut; (39) A government hut for visitors up in the mountains near the crater lake; (40) Making "kava," a native drink; (41–43) The crater lake; (44) Our boys bathing in the crater lake; (45) Natives of Samoa; (46) A family group; (47) Clearing the forest; (48–52) Views in the Samoa islands; (53) Native soldiers and police, Pago-Pago; (54 and 55) Pago-Pago.

New Zealand. **Stark.**

Six photographs of the Great Waimangu geyser, taken by W. Emery Stark, Esq. *Presented by W. Emery Stark, Esq.*

A most interesting set of six photographs of the Great Waimungu geyser (North island, New Zealand), which broke out for the first time in January, 1901. It is in eruption about every thirty-six hours, and these photographs show six different stages of the eruption, on April 17, 1903, from its early indications to the final stage.

New Zealand. **Stark.**

Eight photographs of the New Zealand Alps, taken by W. Emery Stark, Esq. *Presented by W. Emery Stark, Esq.*

These photographs vary in merit, but some of them are remarkably good. They are enlargements, measuring 7½ inches by 9½ inches. One or two of the Tasman glacier are especially interesting.

(1) Mount Cook; (2) Mount Cook from the "Governor's Bush;" (3) The Tasman glacier with the Dome; (4) The Tasman glacier with Mount de la Beche; (5) The Tasman glacier with Mount Tasman; (6) The moraine, Tasman glacier; (7) Mount Sefton; (8) Mr. Stark's glacial work on the Tasman glacier.

Northern Nigeria. **Burdon.**

Twenty-one photographs of Northern Nigeria, taken by Major J. A. Burdon, C.M.G. *Presented by Major J. A. Burdon, C.M.G.*

Major Burdon was appointed British Resident of Sokoto soon after the country came under British rule, and, during his official visits to native chiefs and others, has had exceptional opportunities of photographing some of the leading persons and interesting scenes at an important historic period. Several of the photographs illustrate Major Burdon's paper in the last number of the *Geographical Journal*. The following are the abbreviated titles, but a very complete description has been written upon each photograph:—

(1) The Sarikin Muslimin and Waziri of Sokoto; (2) Mohammadu Maiturare, Marafa of Sokoto; (3) Malam 'Akal; (4) The Sarikin Yamma, headman of Dogon Daji; (5) Mainasara, a native of the upper Benue; (6) Kiari, a native of Western Bornu; (7) The Emir of Argungu, the heir to the Gando Emirate; (8) Kiari, senior native political agent, Northern Nigeria; (9) Police barracks, Sokoto; (10) The plain outside Sokoto; (11) Government House, Zungeru; (12) View from the verandah of Government House, Zungeru; (13) The Sarikin Tambawel; (14) Natives of Sokoto; (15) A street in Sokoto; (16) Sokoto horsemen; (17) The tomb of Othman dan Todio at Sokoto; (18) Native compound, Sokoto; (19) Native horsemen at Sainyinna; (20) Jarumai, messenger of the Emir of Argungu; (21) Group of native horsemen.

Siam. **Adam.**

Nineteen photographs taken in the Province of Monthon, West Siam, by Frank Adam, Esq. *Presented by Frank Adam, Esq.*

Mr. Frank Adams is a resident at Puket, Island of Tongkah, West Siam, and has exceptional opportunities of visiting some of the little-known localities of that part of the country. During his visits he has taken these photographs, of which he has been good enough to send us copies. The titles are as follows:—

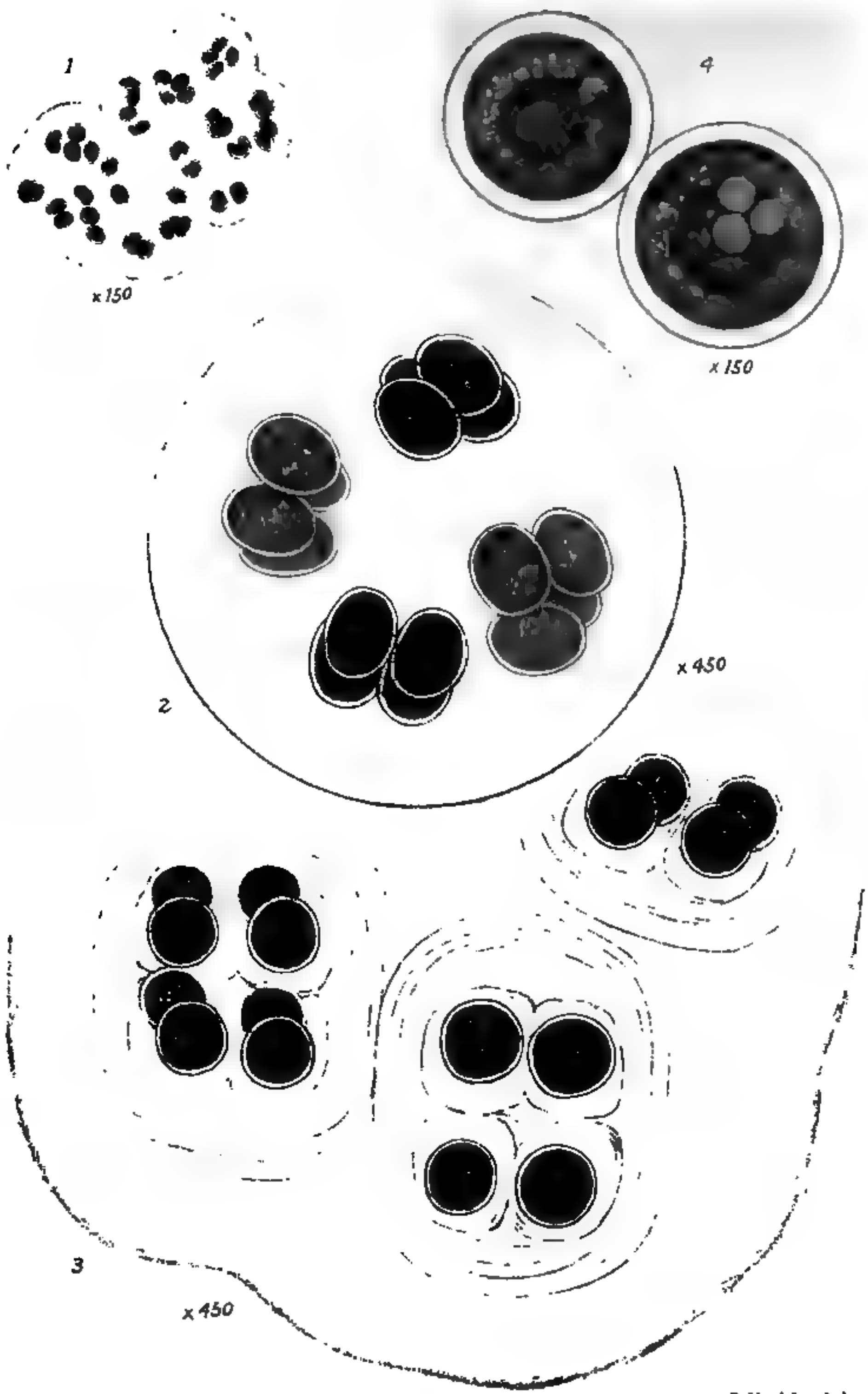
(1) View of Tongkah hill; (2 and 5) Tongkah bay; (3) Siamese house at the foot of Tongkah hill; (4) Watt, Puket; (6) Puket; (7) Tongkah harbour; (8) Straits of Salang, looking south-east; (9) Straits of Salang, looking north-west; (10 to 13) Islands in the Straits of Salang; (14 and 15) Mouth of the Pangna river; (16 and 17) The Takopah river; (18) Mouth of the Renong river; (19) View of the town and mountains of Renong.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

GORONGOZA.

REID.

THE GEOGRAPHICAL JOURNAL 1905.



E. A. Wilson del. P. Highley lith

Clemensia Markhamiana

The

Geographical Journal.

No. 2. FEBRUARY, 1905. Vol. XXV.

ON A NEW GENUS OF ALGÆ, CLEMENTSIA MARKHAMIANA.*

By GEORGE MURRAY, F.R.S.

It was a great pleasure, and I might be excused for thinking it a triumph, that the first new organism which fell to the bag of the *Discovery* should have fallen to my personal share. A new species would have been welcome. My delight was the greater when I realized that I was face to face with a new generic type. This realization did not come at once. In looking into my diary, I find that for a whole day I puzzled over the possible relationships of this organism, unwilling as I am to think a type new; to think I should be the first to see something no human student of pelagic organisms should have seen before, and this a generic type! If a personal reference in one sentence may be excused, I may claim the permission to recall a day of restraint when I tried to disguise from Captain Scott (who had taken an active interest in the microscopic study of plankton) and from Dr. Koettlitz my hopes and, it may be, my fears. The next morning's tow nettings brought in mature forms, which enabled me to decide once and for all that the *Discovery* had captured a new type of pelagic organism—a generic type which can most fittingly bear the name of the man who initiated the *Discovery* Expedition; the name is *Clementsia Markhamiana.*

There were many who did their best; the President did his best so conspicuously from the first that it is fitting his name should be that of this first organism to be named after the expedition.

On the next day, to my great delight and particular pleasure, Dr. Koettlitz discovered a new species of Peridinian. I had thought the ocean was exhausted of Peridinians; they were my own particular preserve, and here was my own particular pupil in such matters, Dr. Koettlitz, beating his master on his own ground. With his characteristic modesty, he met me on the deck for a verification, and

* In the plate the name is incorrectly given as *Clemensia.*

scarcely before I had spoken, Dr. Koettlitz had announced a new species, to be called after our captain. This species Dr. Koettlitz will describe in due course.

The original drawings of *Clementsia* were made by Dr. Wilson at the time of its capture, and the engraving is by Mr. Highley.

The particular interest in this type is not only its unique character as an oceanic plant, but its significance from the point of view of the geographical distribution of such organisms. There are allied forms, both Glœocapsoid and Chlorococcoid—not well defined for the most part—on sea-shores, but I have never met with, either under the microscope at sea (I mean the high seas) or in botanical records, anything nearly related to *Clementsia.* Its nearest allies are from fresh water, and this fact alone will account to any naturalist for my day of bewilderment mentioned above.

The difficulty that arises in interpreting the development and life-history of pelagic organisms is this: one cannot submit them to the normal tests of cultivation, as one would do with fungal and bacterial organisms, or with fresh-water algæ. The only real groundwork to go upon is the assembling of numerous specimens, and the intelligent understanding of these specimens in their various stages by the light of the known life-history of allied forms. This must be done in the case of *Clementsia*, and I shall try to show what I take to be its course of development.

Fig. 1 shows what I take to be the youngest stage in which the cells are living in association—in colonies—enveloped in a common mucilaginous membrane. In Figs. 2 and 3 we see (much more highly magnified) the process of subdivision of the cells, a division into fours, and especially in Fig. 3 these forms are displayed in an encysted, stratified integument. The next ascertained stage is Fig. 4, in which we have the escaped cells grown much larger and free, and—such is my interpretation—about to give birth, or inevitably destined to give birth, to a colony like that shown in Fig. 1. This interpretation is based, of course, on known facts in the life-history of allied forms. No man can tell from the available material what may happen between the stage shown in Fig. 4 and the establishment of the colony shown in Fig. 1. The magnification is identical. It will be seen there is a great increase in size in these cells from the subdividing stage in Figs. 2 and 3, as would be expected in a stage about to establish a colony such as that shown in Fig. 1.

Clementsia Markhamiana, nov. gen. et spec.

Units existing in colonies within a stratified integument, dividing into groups of four, varying much in the numbers of the colony; the integument gradually growing in thickness and in stratification, ultimately bursting and permitting the escape of the unit cells; unit

cells increasing in size markedly and (presumably) subdividing into colonies like the parent colony; in nearly every stage characterized by the thick and many times stratified walls of the integument, and especially also by the abundant oily and chlorophyllaceous contents of the cells.

Lat. 7° S. to 12° S.; long. 30° W. to 33° W.

ON CERTAIN RECENT CHANGES IN THE CRATER OF STROMBOLI.

By TEMPEST ANDERSON, M.D., D.Sc.

In 1875, Prof. Judd, F.R.S., published in the *Geological Magazine* an admirable series of articles entitled "Contributions to the Study of Volcanoes."

The part dealing with the Lipari islands has been my constant companion and guide during two visits to those islands in 1888 and 1904, and it deals so fully with the subject, both from a historical and scientific point of view, that I feel it would be presumptuous to attempt to paraphrase the excellent description which he has so well written. Since his visit, however, Stromboli has continued in its wonted activity, generally of a moderate character, and so regular that it might almost be called rhythmical, though occasionally varied with periods of violence, and sometimes of almost total quiescence. As a result, certain changes have occurred in and about its crater; not on any very large scale, it is true, but sufficient to be of interest. When I visited the islands in 1888, I carried with me a camera, with which I took photographs * from selected points of view, believing that I was thus securing records more accurate and unbiassed than any mere verbal description; and in 1904 I revisited the islands, carrying the same camera and lenses, and took comparison photographs from as nearly as possible the same positions. These photographs form the basis of this paper, and have been supplemented by several other photographs and diagrams placed at my disposal by Prof. Riccò, of the Reale Osservatorio, Catania, and Mr. Geo. S. Eunson, of Northampton, who visited the volcano with the Geologists' Association in 1889. These fill up the gaps and show the changes during the intervening years.

Believing as I do that photographs should themselves form the record, and that the letterpress should be mainly explanatory of them, I have placed opposite each plate a note calling attention to the main points shown, and prefaced the whole by such a description of the island as may serve to make my story intelligible. To this I have added a summary of the main changes noticed.

Stromboli is the most easterly and northerly of the Lipari islands. It is situated north of Sicily, close to the track of steamers plying

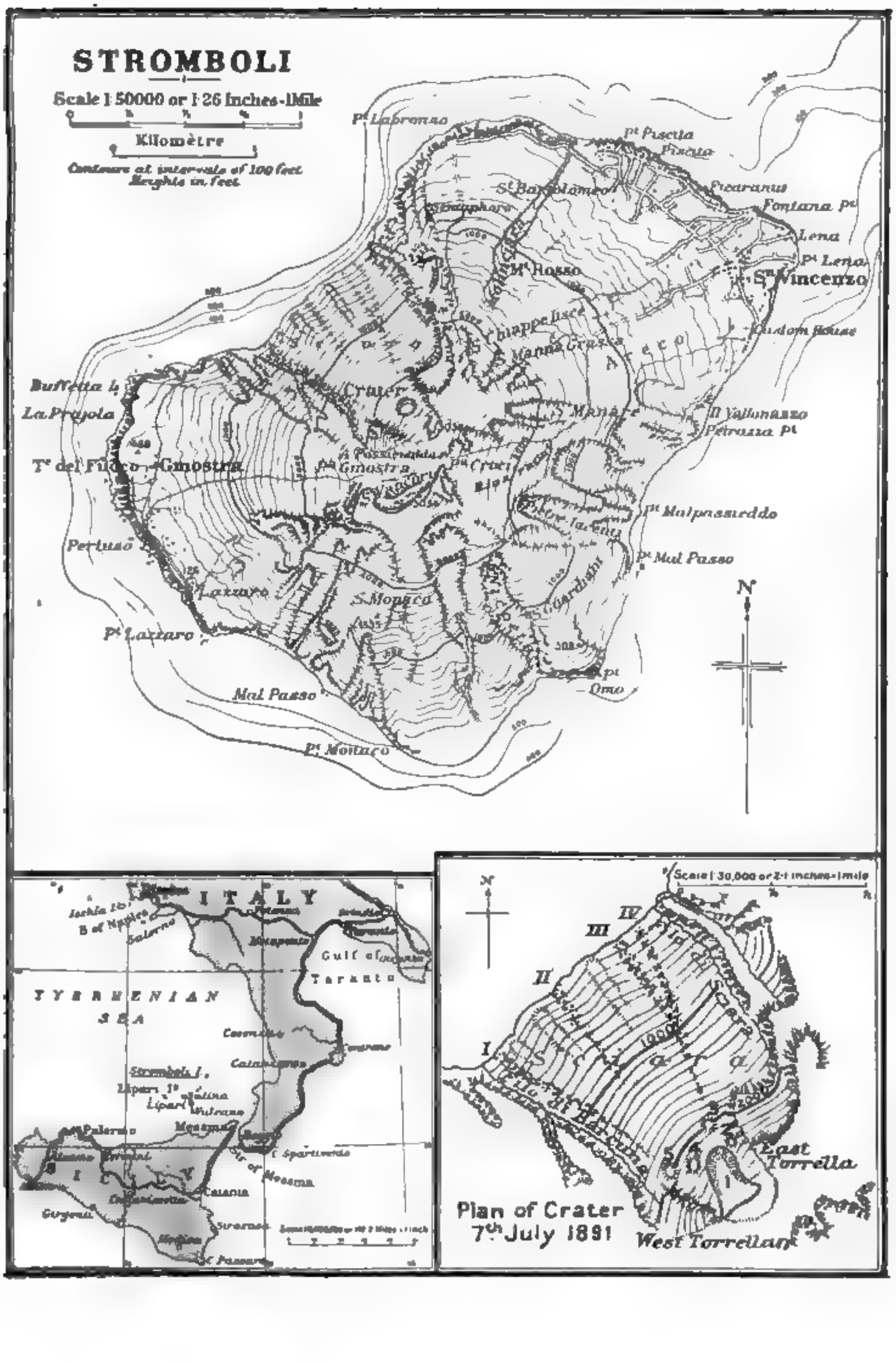
* See 'Volcanic Studies by Tempest Anderson.' Plates xx. to xxvii. Murray: 1903.

between Naples and the Straits of Messina, and is thus an object familiar to passengers to or from Egypt or the East, though comparatively few have landed on its shores. Its almost constant eruptions have gained it the name of the lighthouse of the Mediterranean. It is almost circular, as its old name Strongyle indicates, and rises as an irregular cone out of deep water. On the north-west side is the crater, "Apparato Eruttivo," of the Italian observers, and the Sciara or steep slope down which the ejecta roll into the sea. The Sciara is bounded on each side by two steep cliffs, Filo di Sciara and Filo di Baraona, which are formed, like the Sciara itself, of lava-streams, agglomerates, and dykes; in fact, of almost every kind of compact volcanic material, chiefly of basic composition.

The summit of the mountain consists of a crescentic ridge, the Serra di Vancori, open towards the north. It forms part of an old crater ring, and thus presents points of similarity to Somma. Inside the crescent ridge, and in places joined to it by irregular crests of rock, but mainly separated from it by a valley, "A Fossieiedda," similar to the Atrio del Cavallo of Vesuvius, is another crescentic ridge, which, on my first visit in 1888, in many places immediately surrounded the active crater, the bottom of which was visible therefrom. In 1904, owing to changes presently to be described, this view was not obtainable.

Connected with its two extremities, and immediately overlooking the sides of the crater, are two conspicuous pointed rocks, the Torrelle,* which partly obstruct the view of the crater when viewed from the cliffs overlooking the Sciara on its north-east and south-west respectively. These Torrelle, being practically unaltered by ordinary eruptions, present good points of comparison for estimating the changes that take place, and one or other of them is included in most of the photographs. Between the two Torrelle, in the midst of a sort of amphitheatre formed by them and the crescentic ridge last mentioned, is the crater and its appurtenances, "The Apparato Eruttivo" of Italian observers. This amphitheatre is open to the north-west, and from its open side beyond the craters the steep slope of the Sciara extends down into the sea. This Sciara, as is well known, is one of the most peculiar features of this volcano. It extends at an angle of about 35°, which is the "angle of repose" for the kind of material of which it is composed, down into the deep water of the Mediterranean; and though the volcano has certainly been in almost constant eruption during the whole of the historic period and probably much longer, it has never been able to build up a talus sufficient to rise to the level of the sea, much less to that of the lip of the crater, about which, according to the analogy of other volcanoes, it might have been expected to have built up a cone on this side comparable to the portion on the south described above,

* We heard these rocks called by the natives Torrelle ["little towers"] and Torrione ["big towers"]. They are spoken of by Profs. Riccò and Mercalli as Faraglioni.


STROMBOLI
Scale 1:50000 or 1·26 Inches=1Mile
Kilomètre
Contours at intervals of 100 feet
Heights in feet
Pt Labronzo
Pt Piscita
Piscita
S. Bartolomeo
Fontana Pt
Lena
Pt Lena
Mt Rosso
Sn Vincenzo
Custom House
Buffetta I.
La Prajola
Crater
Il Vallonazzo
Petrazza Pt
Gmostra
Pt Malpassueddo
Pt Mal Passo
Lazzaro
S. Monaca
Pt Lazzaro
Mal Passo
Pt Omo
Pt Monaco
N
ITALY
Gulf of Taranto
Taranto
TYRRHENIAN SEA
Stromboli I.
Palermo
Messina
Catania
N
I
II
III
IV
East Torrella
Plan of Crater
7th July 1891
West Torrella

On November 17, 1882, and following days, a severe eruption took place. Towards the commencement there was an explosion more severe than any remembered by the inhabitants, and five new bocche opened on the north-west slope of the Sciara, about 100 metres below the usually active crater. Red-hot stones were thrown on to the southern slopes of the mountain, and one weighing several tons as far as Ginostra. On November 27 the eruption was so severe that the inhabitants thought of emigrating. No lava-flow took place. Mercali contrasts this fact with the usual sequence of events on Etna and Vesuvius.*

On February 25, 1888, there was a severe earthquake on Stromboli, and others on March 21 and May 22. They were local, and not felt on the other islands. Mercali concludes that they were connected with the local volcanic activity, although the eruptions continued with their usual degree of intensity, and that they were different from the Calabrian earthquakes. Such local earthquakes are common in the Lipari islands.

Mercali visited Stromboli in September, 1888, and found a single active crater. In February, 1889, he found the crater more active and notably changed. The bocca active in September, 1888, was now quiet and in a fumarolic condition, and three new bocche had opened on the edge of the Sciara, one of which gave eruptions with a rhythm independent of the others.

In June, 1891, Profs. A. Riccò, of Catania, and G. Mercali, of Naples, visited the island and embodied their observations in a valuable memoir † from which the plan is copied by permission, and the nomenclature and numbering of the bocche adopted by them has also been followed throughout this paper.

They found a large crater, No. 1, corresponding to that described above by myself in 1888, and figured in Plate II., and four smaller bocche on or about its northern edge at the lip of the Sciara. Bocche Nos. 2 and 3, towards the eastern side of the crater, were considered to be situated on one radial fissure, and they appear to correspond in position to the smoking cone of 1888, and to the fumarolic area observed in the same region in 1904. Bocche Nos. 4 and 5, towards the western portion of the crater, are described as situated on another radial fissure. They correspond in position to the cone from which the explosive eruptions took place in 1888, and to the bocche from which similar explosions still took place in 1904.

The writers also describe and mark three streams of lava, ii., iii., iv.,

* Mercali, *op. cit.*, vol. 27, 1884.

† 'Sopra il Periodo Eruttivo dello Stromboli, Relazione dei Professori A. Riccò e G. Mercali con appendice del Ingegnere S. Arcidiacono estratto dagli Annali dell' Uffizio centrale Meteorologico e Geodinamico,' Serie 2, Parte iii. vol. 11, 1889. Roma: Tip. dell' unione Coop., edit. 1892.

as having run down the Sciara in June, 1891, from bocca 3. It is noticeable that this discharge of lava took place from a bocca which usually is quiet and fumarolic in its action, and not from the usually explosive area 4 and 5.

In 1889 the English Geologists' Association visited Stromboli, and Plate V., from a photograph by Mr. G. S. Eunson, who was one of the party, shows that changes were already commencing.

Signor Guiseppe Renda, postmaster of Stromboli, informed me that about 1890 a stream of lava with three tongues issued from the crater and ran down the Sciara. He fixed the date as having been two years after the great eruption of Vulcano in 1898. This corresponds probably with the eruption described by Profs. Riccò and Mercali as above.

Scattered through the volumes of the *Bolletino della Societa Sismologica Italiana* since their commencement in 1895, are numerous notices by Prof. Riccò and Signor Arcidiacono, both of the Reale Osservatorio of Catania, on the state of the activity of the volcanoes of Sicily and the adjacent islands. These are virtually inaccessible to English readers, as only about two copies appear to find their way into this country, but, thanks to the courtesy of Prof. Milne, F.R.S., I have been able to abstract the following information.

1895. Stromboli was in its usual characteristic state of eruption, except that on March 29 a very violent explosion occurred in correspondence with a slight shock of earthquake felt in several places in Calabria. There followed towards the end of the year several violent explosions sufficiently severe to shake the island. A small stream of lava issued from the Sciara below the bocca 4 this year or in 1894.

1896. Stromboli was in its usual condition during the whole year, except that on July 13 there was a severe explosion, by which masses of incandescent lava and scoria were thrown to a great distance, and some damage was done to the vineyards by fires in consequence. The whole island was enveloped in a cloud of ash, and the noise was heard very plainly at Lipari. A slight shock of earthquake was felt at Palini, in Calabria.

1897. Nothing special was recorded.

1898. Stromboli was chiefly in its usual state. It was more active than usual in October, and unusually quiet in November. On September 14, 1898, Signor A. Semprivi Capo Posto Semaphoro di Stromboli ascended the mountain, and, all being quiet, was able to ascend the western Faraglioni (Torrella), commanding a good view of the craters from above, and found the relative positions of the bocche had not materially varied since the original report by Prof. Riccò, Mercali, and Archidiacono in 1891. No. 5 was still in action, but its direction somewhat changed, so that it could scarcely be seen from the semaphore. It appeared to be the point from which most of the larger explosions took place. On October 28, 1898, Prof.

Riccò ascended the mountain and observed a succession of eruptions. Four considerable ones, besides smaller ones, took place from bocca No. 1, some moderate ones from No. 4, while Nos. 2 and 3 discharged masses of smoke.

1899. Stromboli was mostly in its usual condition, with occasional increases of activity. There was a slight increase of activity at the beginning of February. On March 6 a very violent explosion occurred in one of the side craters, followed by the formation of two small cones in its floor, and on the following days increased activity continued. During this year Prof. Matteucci stayed nine days on Stromboli, and made six ascents. The eruptions all took place from a little eccentric cone on the southern slope of a large crater of explosion, probably 4, 4 bis, or 5, and there were six other bocche, but they only emitted smoke. The mountain was again active in November, and about the 10th of that month a new bocca, No. 6, opened on the Sciara below and to the north-east of No. 5.

1900. Stromboli was unusually active from March to November, especially in October. Many of the explosions were sufficiently powerful to shake the whole island and cover it with dust. The chief explosions were from bocche 4, 4 bis, and 5, all situated towards the western part of the Sciara. The later observations are not yet published, but Signor Liberator Castalan, syndic of Filicudi, whose house commands a full view of Stromboli, informed me that there was a severe eruption of Stromboli in December, 1903, and January, 1904, also others five and ten years previously. Between those times nothing special occurred, but the mountain was never absolutely quiet.

Signor Guiseppe Renda, Postmaster of Stromboli, also spoke of an eruption in November and December, 1903, during which a stream of lava ran down the Sciara from about December 10 to 20, and a new bocca formed on the north-eastern part of the eruptive area near the Torrione (Torrella ?).

There was an earthquake in February, 1904.

1904. I stayed four days on the island, and ascended the cone on April 20 and 22. The photographs were taken April 20.

On May 30, 1904, Signor D. Vasalo, Capo Posto del Semaphoro di Stromboli,* made an ascent of the mountain, and, the craters being quiet, was able to ascend the eastern Faraglioni (Torrella), from whence he had a near view of the "Apparato Eruttivo." He found in the part which I have called the fumarolic area a new bocca, which he calls No. 7. It is about 20 metres east-south-east from bocca 2, and about 6 metres by 4 metres in extent. It was in a state of the weakest activity, and emitted whitish smoke, apparently being in a similar condition to that on April 20, when I photographed the locality, as shown in Plate IV.

* See *Boll. della Soc. Sism. Ital.*, vol. 10.

He also found the large crater No. 1 filled up as described above, probably during the eruption of November, 1903. It is very satisfactory to find my observations in this respect independently confirmed.

He also climbed the western Faraglioni (Torrella) and noted the condition of the western bocche, which were still the most active.

The following information, though not strictly scientific, may be of interest or use to intending visitors.

The southern part of the island is precipitous, and for the most part uncultivated. The north-eastern part is gently sloping, and presents a large village (St. Vincenzo), or perhaps rather a large straggling group of houses, with two churches, situated among vineyards. From the cultivation of these and from fishing, the inhabitants, who number perhaps 4000, derive a precarious livelihood. To the west of the village, and on a promontory near the eastern side of the Sciara, is a signal station maintained by the Italian Government, where the passage of vessels is recorded and reported. One of the officials here is charged with keeping a diary of the state of activity of the volcano, and he reports to Prof. Riccò, of the observatory of Catania.

The only other person who seemed to know anything about or take any interest in the doings of the volcano was the postmaster, Signor Guiseppe Renda.

There is another small village, Ginostra, to the west of the island. There is no inn on the island, but tolerable lodgings are obtainable at the house of Don Antonio Renda, who did his best to make us comfortable. A small steamer calls twice a week. It goes daily from Milazzo to Lipari, and some one or other of the islands, and there is a steamer once a week to Messina. There is no harbour, but passengers are landed in small boats. If the wind is unfavourable, landing is sometimes impossible.

We took as guide Francesco Conti from Lipari, who has been in America and speaks some English.

In conclusion, I wish to express my grateful thanks to H.I.H. the Archduke Ludwig Salvator of Tuscany, for allowing the reproduction of the map from his monumental work, 'Die Liparischen Inseln,' Siebendes Heft (Stromboli, 1896); to Prof. Riccò, of Catania, for much valuable assistance, and for permitting the reproduction of the inset plan of the crater and Sciara; to my valued friends Prof. Bonney, F.R.S., Prof. Judd, F.R.S., Prof. Milne, F.R.S., and George Yeld, my companion during the voyage, for much kind assistance and counsel; and to Mr. Geo. S. Eunson, of Northampton, for the use of the negative of Plate V.

PLATE I.

THE SERRA DI VANCORI, STROMBOLI.

(*From a Photograph by the Author*, 1904.)

In the distance to the right and in the centre is the crescentic range of cliffs forming the southern part of the old wall of the crater. It is composed chiefly of tuffs and agglomerates, with, I believe, a few small flows of compact lava. The slope in the foreground and to the left is part of the ridge overlooking the site of the crater existing in 1888, but now much filled up. It is composed of fragmentary ejecta, including many large masses of scoria and a few very perfect volcanic bombs. The depression in the distance to the left is the Purtedda di Cruci, over which the track from Ginostra leads down to San Vincenzo, the chief village of the island.

STROMBOLI. THE SERRA DI VANCORI

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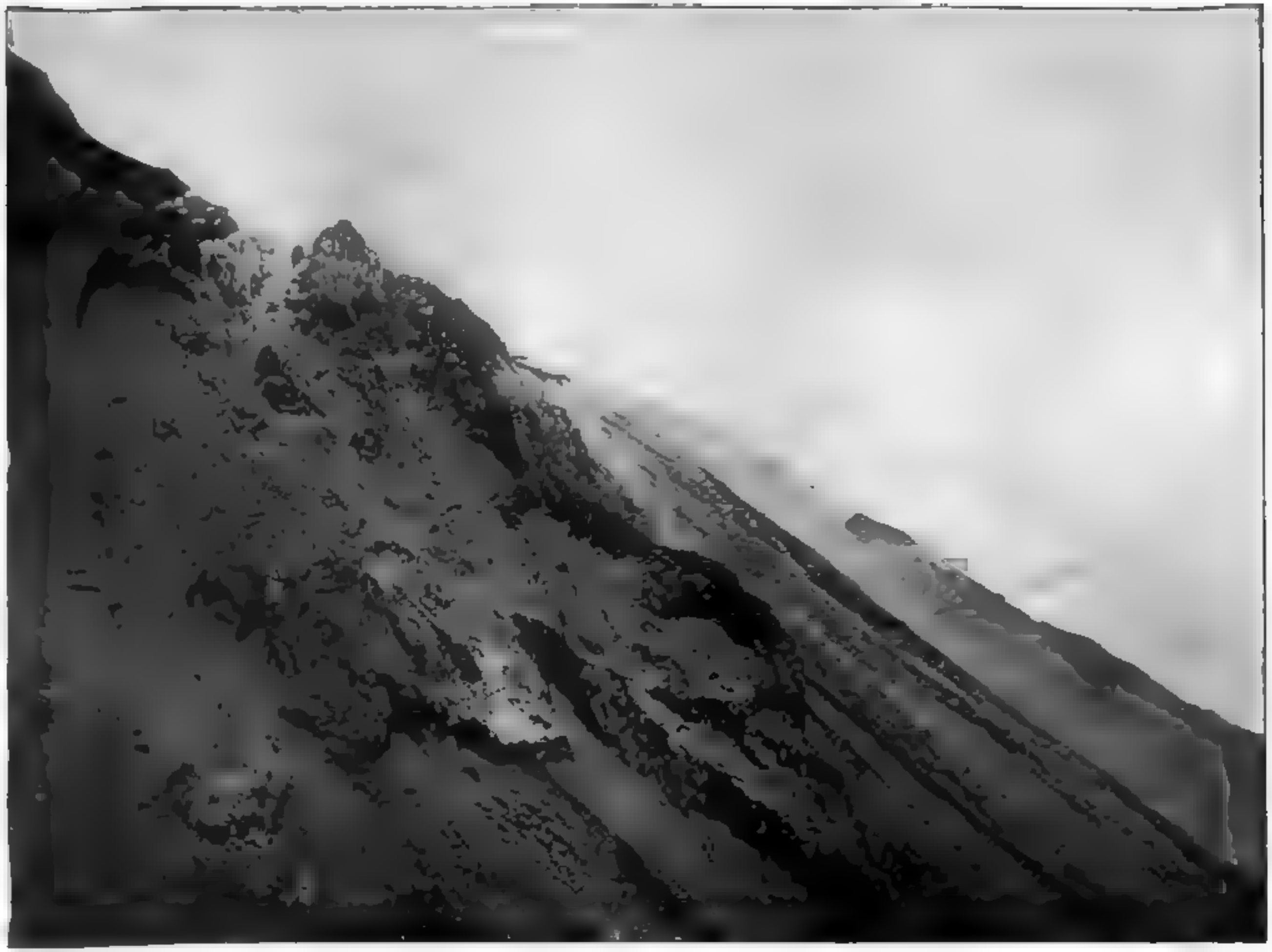
Purtedda di Cruci.

Old Crater Wall

STROMBOLI. THE SERRA DI VANCORI

PLATE III.

Western Torrella.
Eastern Torrella.
Crater
Wedge-shaped dyke.
Isla di Barcuna
Sciara

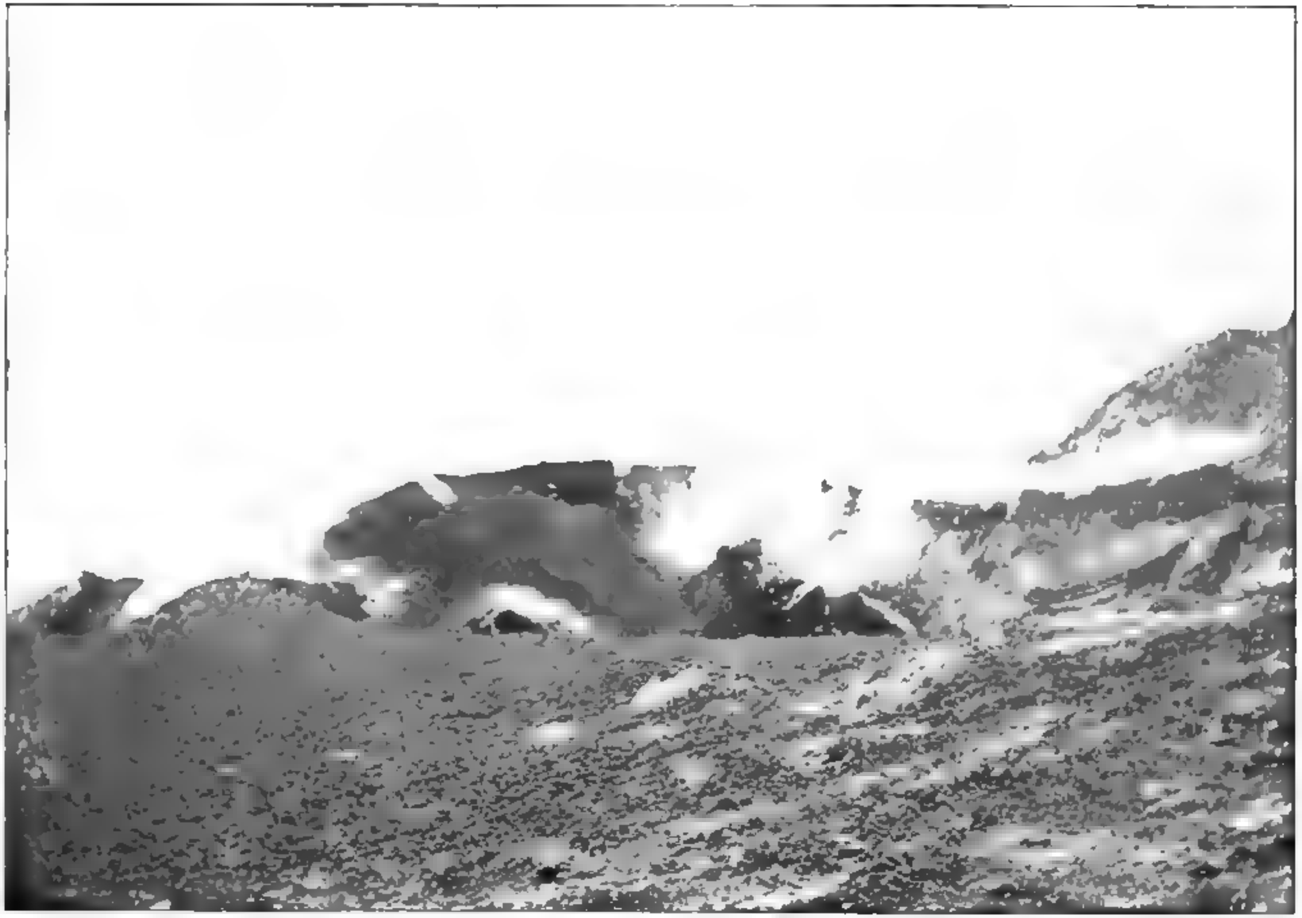


STROMBOLI: THE SCIARA FROM THE NORTH-EAST. 1888.

PLATE II.

Bocca 4.

Bocche 2 and 3.



STROMBOLI. THE CRATER FROM ABOVE. 1888.

PLATE II.

STROMBOLI—THE CRATER FROM ABOVE.

(From 'Volcanic Studies,' Plate XXII., by Tempest Anderson.)

This photograph shows the condition of the crater in 1888. It was taken from the slope extending down from the north side of the ridge shown to the left of the last plate, towards the crater, and with the camera pointed in a northerly direction. Owing to the necessity of tilting the camera forward in order to obtain this view, the slope in the foreground is much foreshortened. It is in reality very steep—in fact, "at the angle of repose." The crater was an elliptical hollow, probably at least 60 or 70 yards in its longer diameter, and contained two small secondary cones. A considerable amount of vapour escaped steadily from the cone to the right, which appears to be on the site of bocche 2 and 3 (Riccò and Mercali), and also from several fumaroles. Explosions took place from the cone to the left, bocca No. 4, every few minutes. The further or north-west side of the crater was the upper edge of the Sciara, down which such of the ejecta as fell in that direction rolled into the sea.

When I visited the same spot in 1904, intending to take a comparison photograph, I found the crater quite filled up, and the slope of the Sciara continued upwards over its site, so as to form a great ridge right across the foreground of this picture, which concealed the bocca from view. There was a hollow in front of the ridge, but further up the slope than the old crater, and it contained no fumaroles.

PLATE III.

Stromboli—The Sciara from the North-East.

(*From 'Volcanic Studies,' Plate XXI., by Tempest Anderson.*)

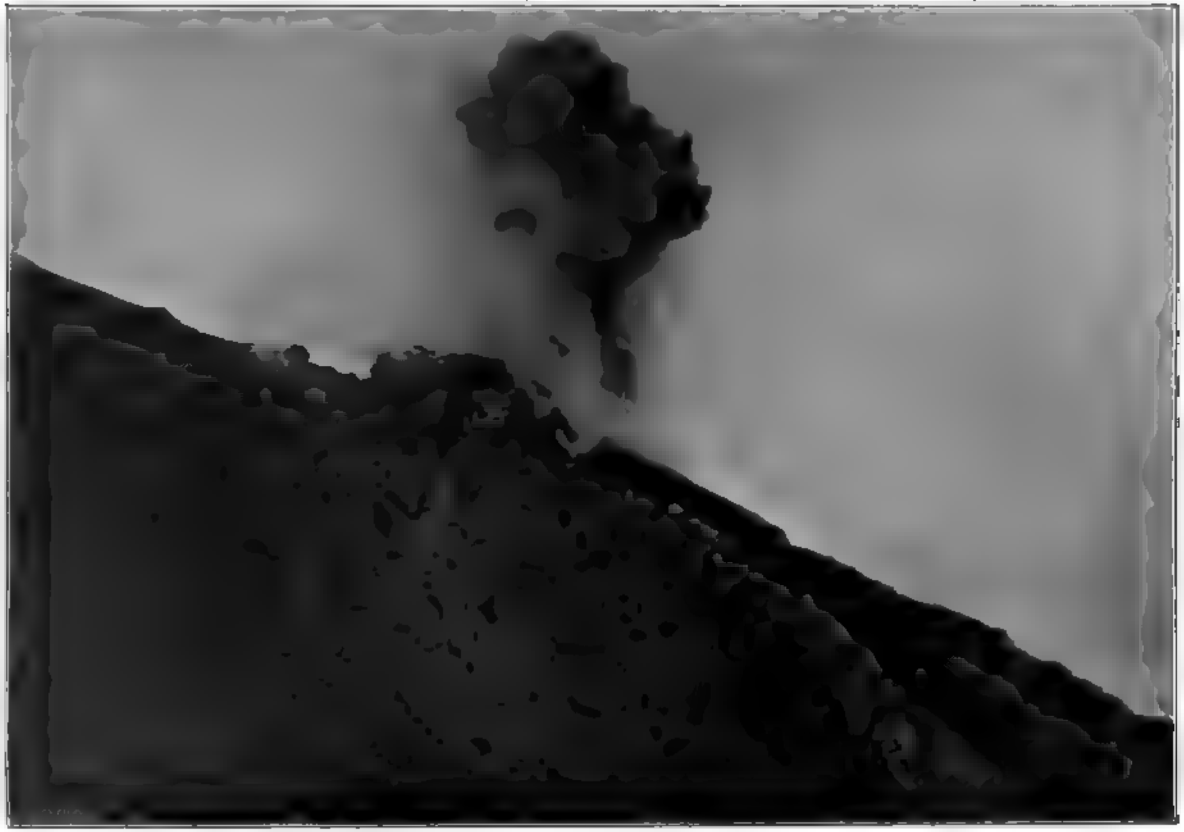
This photograph, taken by the author in 1888 from the ridge overlooking the north-east side of the Sciara, and consequently looking south-west, shows the crater partly concealed from view behind the eastern Torrella, the conspicuous pointed rock to the left, in the distance behind which the western Torrella is just visible. The lip of the crater is just above a large wedge-shaped dyke, which also appears in the next plate. The slope extending down to the right is the Sciara. It reaches from the edge of the crater down to the sea at a slope of about 30°, and its width at the water's edge is about 3000 feet. The edge of the crater has an elevation of about 2400 feet. To the left is a rugged slope, which leads from the left of the Torrella down to the Sciara and the sea, and down which ejecta are thrown during the larger eruptions.

PLATE III.


Western Torrella.
Crater.
Eastern Torrella.
Wedge-shaped dyke.
Fila di Barcuna
Sciara

PLATE IV.

Fumarolic Area
Terrella.
Wedge-shaped Dyke.



STROMBOLI: THE SCIARA FROM THE NORTH-EAST. 1904.

PLATE IV.

STROMBOLI—THE SCIARA FROM THE NORTH-EAST.

(*From a Photograph by the Author*, 1904.)

This photograph was taken on April 20, 1904, from the cliff overlooking the Sciara on the north-east, and thus from the same general direction as the last, but perhaps a little higher up the slope, and, being taken with a longer-focus lens, less of the subject is included. To the right is the slope of the Sciara leading down to the sea, with the cliff behind it corresponding to the one on which we are standing. In the centre is the Torrella, with the slope of the Sciara continued up behind it, and showing the large fumarolic area (bocche 2 and 3). This area was much covered with yellow incrustations, and vapours escaped from innumerable points and cracks. There was one small bocca, from which very feeble explosions took place. They were more frequent than, and quite independent in rhythm from, those taking place from the more western parts. In the background are seen the products of an explosion which has just taken place from a bocca beyond the limits of view, probably No. 4 or 5. In the foreground rather to the right is the same wedge-shaped dyke as in the last plate. Compare the position of the crater in relation to this dyke and the Torrella with that shown in the last plate.

PLATE V.

Stromboli—The Crater from the West.

This photograph was taken by George S. Eunson, of Northampton, on September 19, 1889, during a visit to the Lipari islands along with the Geologists' Association.

It is taken from the end of a projecting ridge to the west of the crater and to the north of the Purtedda di Ginostra (see map and Plate VI., Fig. 1), and consequently in exactly the opposite direction to Plates III. and IV. To the right is the western Torrella, and in the distance behind is the eastern Torrella and the adjacent heights. Between the two is the Apparato Eruttivo, as it is appropriately called by the Italian observers. The bocca which emits smoke in the centre of the picture, and from which the chief explosions take place, appears to be the same as the cone shown at the left of Plate II., but its cone is already beginning to grow a little towards the larger crater which still exists behind and to the right of it. It is probably the same as bocca No. 4 or 5 of Profs. Riccò and Mercali. A small bocca (perhaps No. 3) on the skyline to the left throws out small masses of lava. The Sciara on the left or north side stretches down to the sea, as shown in the previous plates.

PLATE V.

STROMBOLI: THE CRATER FROM THE WEST. 1889.

PLATE

FIG. 1. STROMBOLI FROM THE SEA. 1904.

FIG. 2. THE CRATER FROM THE WEST. 1891.

PLATE VI.—Fig. 1.

Stromboli from the Sea, 1904.

This photograph, taken by the author from a small steamer, shows the Sciara in the centre and towards the left of the picture extending from the craters down to the sea. Rather below the centre is a rough patch, the remains of a stream of lava, probably one of those of June 24–30, 1891.

The other points of interest can be best identified by the letters.

a. The Filo del Fuoco, otherwise Fila d'a Sciara, the rocky precipice bounding the sciara on the east. Plates III. and IV. were taken from near its upper end. The Semaforo, or signal station, is situated on this slope outside the lower part of the plate.

b. Eastern Torrella, shown more in detail in Plate III.

c. Fumarolic area on site of bocche 2 and 3 (see Plate IV.).

d. Bocche 4 and 5.

e. Western Torrella (see Plates V., VI. (Fig. 2), VII., VIII., IX., X., and XI.).

f. Filo di Baraona, otherwise Fila di Barcuna, the rocky precipice bounding the Sciara on the west.

The plates mentioned in *e* were taken from a point at its summit.

PLATE VI.—Fig. 2.

The Crater of Stromboli from the West, 1891.

This photograph, kindly placed at my disposal by Prof. Riccò, and taken by Ing. S. Arcidiacono, his assistant, shows the crater of Stromboli from the west on September 3, 1891. It appears to have been taken from the same place as Plate V. To the right is the western Torrella; in the distance to the left the eastern Torrella, with the east cliff bounding the Sciara just showing behind it at the edge of the picture. Between the two Torrelle are more than one eruptive bocca, apparently Nos. 3 and 4. The large inactive crater I is behind the western Torrella. It is noticeable that the whole of this "Apparato Eruttivo" is well below the level of the line joining the two Torrelle, though rising higher than in the earlier photographs.

The slope of the Sciara extends from the crater down to the left of the plate.

PLATE VII.

The Crater of Stromboli from the West, 1895.

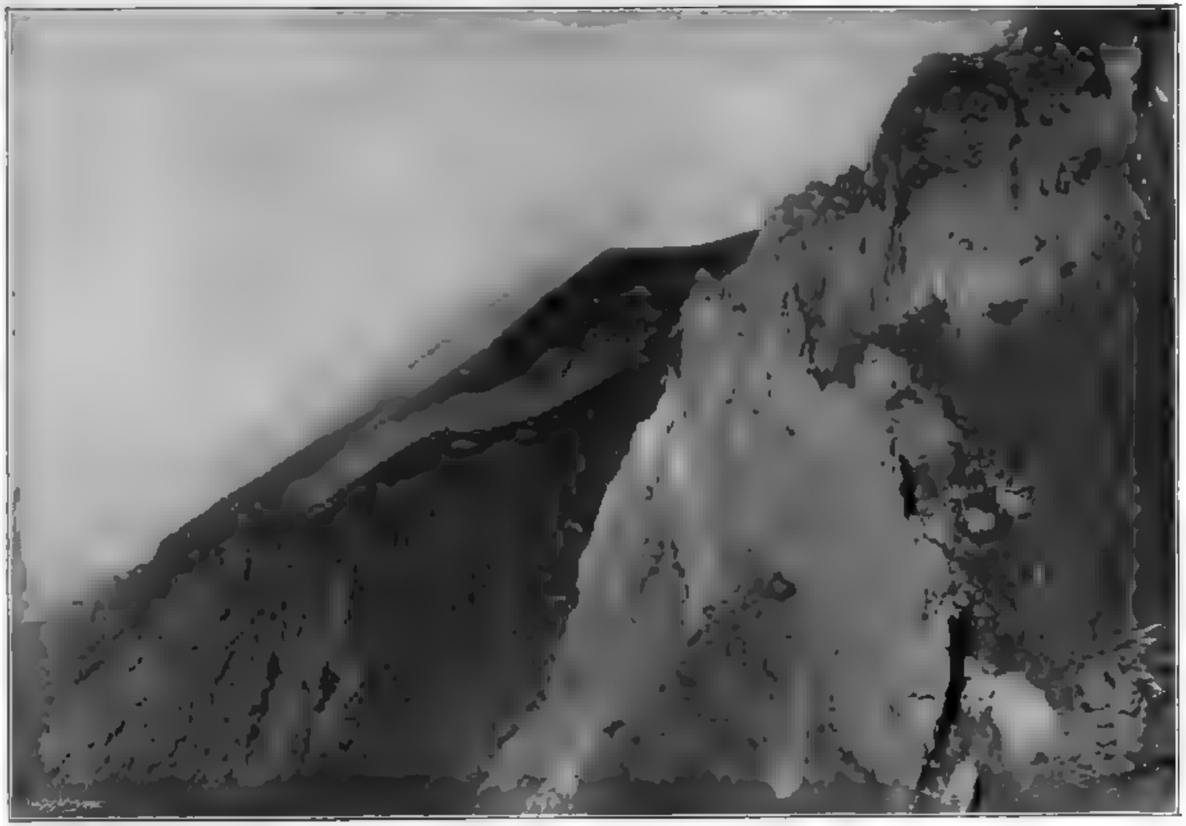
This photograph, placed at my disposal by Prof. Riccò, of Catania, and taken by him on November 21, 1895, apparently from nearly the same point as the last two, shows the condition of the crater above four years later. The western and eastern Torrella occupy corresponding positions to the right and left of the picture respectively. The eruptive area between them shows several bocche, and the slope of the Sciara extends higher than before to the right of the main mouths. The numbers of the bocche are from a figure in a brochure, 'Stato presente dei fenomeni in 1898, Riccò.' The large crater No. 1 is behind the western Torrella.

PLATE VII.

Bocca 3. Bocca 4. Western Torrella.

STROMBOLI: THE CRATER FROM THE WEST. 1895.

PLATE VIII.



THE CRATER FROM THE WEST. 1904.

PLATE VIII.

Stromboli—The Crater from the West.

This photograph, taken by the author April 20, 1904, and from the same point as the last, shows the condition eight and a half years later. The western Torrella is conspicuous as before, but the slope of the Sciara now extends far up to the right beyond the active craters, and conceals the eastern Torrella almost entirely from view. It fills up the large old crater No. 1, which was behind the Torrella. The large bocca in the front of the middle distance was that from which all the explosions took place during my visit, and appears to be No. 4 or 5 of Prof. Riccò's numeration. Those beyond it gave issue to vapour only.

PLATES IX., X., AND XI.

These three photographs were all taken by the author on April 20, 1904, from the same point as Plate VIII., but, not being all done with the same lens, differ in the amount of the subject included. They show different stages of several explosions, all from one bocca. The form assumed, like a cauliflower or a bunch of grapes, though usual in volcanic explosions, is not confined to them. It is often assumed by a mixture of heated gases holding fine powder in suspension, issuing from the chimney of a steamer as well as from that of a volcano. Plate XI. in particular shows the volcanic dust dropping out of the cloud of vapour.

PLATE IX.

STROMBOLI: AN EXPLOSION. EARLY STAGE.

STROMBOLI: AN EXPLOSION. LATER STAGE.

THE MOUNTAINS OF TURKESTAN.*

By ELLSWORTH HUNTINGTON.

The Ontographic Relations of Human Life.

A complete study of geography must consider not only the external habits of plants, animals, and men in relation to their environment, but also human character and methods of thought in so far as they are, directly or indirectly, the product of physiographic conditions. As yet the science of geography is so young that we have grasped but a few of the most elementary of the relations that connect the complex nature of man with his physical environment, and with its indirect effects working through lower forms of life. Indeed, so imperfect is the science that we scarcely know how even to classify the facts belonging to its ontographic half. In the remainder of this paper I shall describe some of the habits and characteristics of the Khirghiz inhabitants of the mountains of Turkestan, and shall attempt to refer them to their physiographic causes. With a certain class of facts, such, for instance, as those relating to diet, this is comparatively easy; with others it is quite impossible. It may be that the high cheek-bones, slit eyes, straight black hair, sparse beards, and small despondent mustaches of the Khirghiz are indirectly due to remote physiographic causes. At present, however, we cannot connect any cause with this effect. Accordingly, the Tartar physiognomy of the Khirghiz must be tentatively pigeon-holed as a fact that may be geographic, but cannot yet be properly classified, and may even, though this is not probable, belong wholly to some other science. In the following pages I shall for the most part omit these doubtful facts that have not yet found a geographic setting, and also, for lack of space, certain others whose physiographic relations are clear. I shall begin with the most important feature of Khirghiz life, the fact that the people are pastoral nomads, and from that shall pass to certain related facts which more or less depend on this main feature.

The Physiographic Conditions of Permanent Nomadism.—The circumstances which favour nomadic life are too well known to need much comment. All races, in their ascent from savagery, may have passed through a nomadic stage, but it is only where the conditions of life are peculiarly favourable that the habit of migrating with their flocks and herds becomes permanently fixed upon a people. The essential conditions are, either that two markedly different climatic zones shall lie so close to one another that it is possible to migrate annually from one to the other, or that in a single region the amount of water or pasture shall be so small that any individual place will support flocks but a few weeks or months at a time. This latter case is that of truly desert countries, such as Arabia, and does not here concern

* Continued from vol. 25, p. 40.

us. In the other case there are two alternatives. In the first alternative, one of the regions is a desert or a mountainous tract where pasture is found during only a certain limited season. The other region is what we call a normal country where permanent agriculture is possible. In such a case nomadism steadily loses ground, because the people more and more devote themselves wholly to agriculture. In the other alternative, one of the regions consists of high mountains that are covered with snow in winter, but furnish fine pasturage in summer, while the second region is one where agriculture is possible, but which is not capable of supporting a growing population, because the climate is either too dry or too cold. Southern Utah, in the basin region of the western United States, furnishes a good example of a country where the lower regions along the edges of the basins are permanently inhabited by an agricultural people in spite of the scarcity of water, while the neighbouring "high plateaus," from 9000 to 10,000 feet above the sea, furnish such good pasture that the inhabitants of the lowlands migrate thither in summer, and have even built rude houses on the uplands. Switzerland, with its chalets, on the other hand, presents an example of nomadism in a country where the lower region is too cool for the highest development of agriculture. In such countries as Utah and Switzerland, the nomadism forced upon the people by physiographic conditions is not necessarily incompatible with a high degree of civilization.

The Nomadism of the Tian Shan.—The nomadism of the Tian Shan is of the same type as that of Switzerland, in spite of the fact that the degree of civilization in the two places is so different. In almost no part of the world is the nomadic life more likely to be permanent than in the region that we are discussing. All the plateau portion of the Tian Shan and much of the Alai region are too cold to allow of cultivation, yet the extent of the uplands and the richness of the summer vegetation enable them to support millions of sheep and cattle. As fall comes on, however, the grass is covered with snow, and the people must take their animals farther and farther down the mountain-side, moving their dwellings as the necessities of the flock require. At last the lowest valley is reached, and the nomad must either stay there through the winter, or risk a journey through the snow over a ridge to another valley. It may happen that his valley is so low and dry as to have no snow during the winter, or that he is on the edge of the mountains, and comes down to the open plains. In that case his manner of life will be the same throughout the year. If, however, the nomad stays in a fairly cool valley, where snow lies for a month or two, he must make some provision for the winter feeding of his animals. In such valleys there is usually a good growth of tall grass during the summer, and this he learns to cut and store in great heaps for use in cold weather. As soon as the process of hay-making becomes habitual, it leads to the repeated use of a single camping site, and

later to the building of permanent houses. The poorer people whose small flocks afford them but a scanty sustenance learn to eke this out by planting hardy grains, and the stage of semi-nomadism begins. The richer people scorn agriculture, and are still pure nomads; the poorer members of the community are perforce half nomadic, half agricultural. In this early stage of semi-nomadism the Khirghiz of the Tian Shan and Alai are to-day. In time they will doubtless come to the true semi-nomadic stage, when, like the mountain Kurds of Turkey, every family has a permanent village habitation, although they spend the summers in tents among the highlands. Further than this they will

THE VALLEY OF KHOJA ISHKEN, AMONG THE ALAI MOUNTAINS. ON THE RIGHT IS A TINY GLACIER.

probably never go, no matter how civilized they become, for, as has already been said, their country is pre-eminently the land of semi-nomadism, and almost forbids any other form of life.

The Khirghiz Nomads.

Domestic Animals.—The preceding generalities prepare the way for a consideration of a few Khirghiz habits and customs which are direct adaptations to a nomadic and pastoral life, and hence may be regarded as ontographic responses to physiographic conditions. The first subject to be considered in this connection is domestic animals, for these are the foundation of all industries and occupations. So pre-eminently is this the case that the word "property" (*mal*) almost always

means live-stock of some sort. The number of kinds of animals is quite limited. Sheep, of a fat-tailed variety, are by far the most common animal, and their milk, flesh, wool, and skin form the indispensable necessities of life. Less numerous and less useful are the oxen and cows, which furnish milk and hides, but are not often eaten. Frequently they are used as baggage animals, and it is no uncommon sight to see a shepherd moving slowly along after his sheep on ox-back. With the oxen must be put the yaks, or "Chinese cattle," as the Khirghiz call them, that are found in small numbers among the nomads whose winter quarters are especially elevated. The milk of yaks, and especially the cream, are delicious. Some of the best of the Khirghiz animals are a cross between yaks and ordinary cattle. Another important animal is the two-humped Bactrian camel, which is kept in part for its milk and hair, but is chiefly valuable as a beast of burden and an article of sale to the people in the neighbouring lowlands. Camels cannot thrive at the higher levels of the Tian Shan plateau, and even at heights of 8000 or 10,000 feet they must, even in summer, be covered with funny coats of felt to keep them warm. The animal *par excellence*, the one to which the unmodified appellation "animal" (*haiwan*) is always understood to apply, is the horse. In such high estimation is he held, that never once during three months' travel do I remember to have seen one used as a pack-animal among the truly nomadic Khirghiz. Most of the horses are small stocky animals, tough and wiry, and with easy gaits, especially the numerous pacers. All are well broken and bridle-wise, and have been well treated, so that few are vicious. The only other important animal is the dog, whose function is to guard the encampment even more than the sheep. Domestic fowls are never met with among true nomads, though one sometimes sees an eagle or a falcon kept for hunting. Some of the poorest people own a few goats and donkeys, but these animals are despised. In spite of the preponderant part played by live-stock in the life of the Khirghiz, the varieties of animals with which he is much concerned are limited to the horse, cow, camel, yak, sheep, and dog.

Dwellings.—Inasmuch as the best pasture for the flocks of the Khirghiz is found close below the continually shifting snow-line, the shepherds and their families must often move their dwellings. Other reasons also render this course advisable. It takes but a few weeks to eat up the finest grass close to the tents, and then either the camp must be moved or the flocks driven further. Again, as the animals are brought close to the encampment at night the ground soon becomes very foul, especially during rainy weather, when there is no chance for it to dry. Accordingly, the kibitkas, as the round felt tents are called, are so built as to be not only thick enough to keep out the heavy rain and snow, but also to be easily taken to pieces and portable. Their appearance and mode of construction are more evident

from the accompanying photographs than from any amount of description. No iron is used in them; the latticework, made of strips of wood 1 inch in diameter, is bound together by bits of raw hide stuck through holes, while the poles which support the roof are tied in place with home-made ropes of wool. Large felts cover the outside, the lower part of which is sometimes still further adorned and protected by matting made of reeds a quarter of an inch thick and 4 feet long, tied so as to stand vertically. The whole dwelling is so made as to fold up compactly into pieces which can be carried by camels or oxen.

Migrations.—Few sights retain their novelty longer than the breaking

DOWN THE VALLEY OF THE TENGIS BAI, IN THE ALAI MOUNTAINS SOUTH OF MARGELAN. IN THE CENTRE OF THE PICTURE IS A SART VILLAGE, LYING ON A TERRACE OF GRAVEL. IN THE BACKGROUND ON EITHER SIDE OF THE STREAM THE LEVEL MOUNTAIN-TOPS SHOW THE OLD PENEPLAIN IN WHICH THE MODERN VALLEYS ARE INCISED.

and the making of a Khirghiz camp and the intervening migration, the ontographic centre around which swings the whole life of these mountain nomads. First, in the early morning, there is the bustle and stir of preparation, the taking down of kibitkas, the gathering of flocks and herds, the catching of neighing horses, the loading of oxen and camels, and the confusion of happy children trying to help in the bustle of this gala day. Then there is the winding procession of animals scattered at intervals along the many-trailed path among the smoothly sloping mountains or in the level basins. Last comes the halt, and the setting up of the graceful frames of the kibitkas on a strip of the

smoothest, greenest sod. At the head of the procession, when first I saw a village arriving at its camping-ground, came a drove of sleek horses, fat mares and frisky colts, running, kicking, neighing, squealing. Then, when the horses had been driven to one side, the loaded camels came gravely on, silent while they were moving, but with fearful roaring and grunting when they were made to kneel to have their loads of felts, rugs, poles, and iron pots removed. With them came the women and children on horseback, the rich wife dressed in green silk, and sitting astride of a silk saddle-cloth of red and yellow, the poor wife in brown cotton. Next, after a considerable interval, came the clumsy pack-oxen, not very noisy except when a dog-fight broke out as they came up, and not very interesting except when an ox ran away with a small boy on top of his load, which adventure caused another small boy of three to run excitedly about in a shirt and a pair of big boots so tall that he could not bend his legs. Quieter still were the cows, and the calves which the boys caught by the tails and tied up by the heads. And quietest of all were the thousand or two of sheep which, after the kibitkas were almost up, came far behind with gentle bleating and the rainy patter of many little feet.

Furniture.—Where migrations are so frequent, the furniture, like the houses, must be easy to pack and move. It consists in part of felts and bright rugs made in the kibitkas from the wool of the household flocks. Another item is the thick quilts made of cotton or silk, stuffed with wool, and admirably adapted to a region where the nights are always cool. Under or beside the pile of these which occupies the side of the kibitka during the daytime are several gay boxes covered with fancy leatherwork and filled with the family treasures. The women take care of the boxes, and carry the keys suspended at their heels by a fancy cord tied to their black braids. On the right side of the kibitka, as one enters, a tall screen of reed matting wound with worsted in bright artistic patterns shelters the cooking-utensils and food, and shuts off a small part of the kibitka for the special work of the women. The only other furniture, unless the pile of saddles be counted, is of an ornamental nature. In rich houses great hangings of silk, fur, and embroidered velvet, the artistic work of the Sarts of the lowlands, are often suspended from the walls.

Utensils.—Among nomads, the utensils, also like the houses and furniture, must be such as can be easily carried on pack-animals without fear of breaking. The commonest receptacle for liquids is a whole sheepskin, scraped and turned inside out. Buckets and flasks are also made of leather. The latter are sometimes 2 feet in diameter, and are of relatively artistic design. A few china bowls of Russian manufacture are used, but most bowls, as well as spoons, are made of wood. Metal is employed for very few utensils, although the most important article for kitchen use is the enormous bowl-shaped caldron of iron in which

the greater part of the food is cooked. Most of the cooking is done over smoky fires of dried dung, the only available fuel in a country where cattle are abundant and trees rare.

Dress.—In dress the Khirghiz find less opportunity for the expression of artistic sense than do their neighbours in warmer regions. Because of the coolness and dampness of the climatic conditions under which the mountain Khirghiz live, the chief garment of both sexes is a long quilted gown of dark-coloured cotton stuff, to which the frequent rains add a deeper hue and greasy shine. Beneath this is usually another long garment of thinner stuff, coloured cotton or, in the case

ABT SHEPHERDS ON THE BORDERS OF BUKHARA AT THE WESTERN END OF THE ALAI BASIN. THESE MEN BUY SHEEP AND GOATS FROM THE KHIRGHIZ, AND DRIVE THEM TO THE CITIES OF FERGHANA.

of the richer women, silk, while the under-clothes are made of white cotton. As a rule, both men and women wear big top-boots of raw hide, admirably adapted to resist mud and dirt. The head-dress affords the chief chance for display of artistic taste. The men wear heavy caps of felt, with turned-up brims of the same material or of lamb's wool, and the young girls wear something similar. The married women, however, glory in enormous, strangely twisted head-dresses of cotton, either pure white or delicately embroidered with pale colours. The twisting of these head-gears is an elaborate affair, and varies considerably from place to place, as the accompanying photographs show. Under the snowy head-dress are various ornaments of silver and

embroidery which hang from the hair and fall over the ears and down to the breast.

Art.—Native Khirghiz art, as displayed in the dwellings, furniture, utensils, and dress of the people, is of a distinct type, though primitive. It expresses itself in the rugs, felts, matting, boxes, utensils, and dress already mentioned, and in fringed bands of cotton cloth that surround the kibitkas just below the roof. These are ornamented with designs made crudely by sewing bits of cloth of one colour upon larger pieces of another colour. Pieces of felt with designs of this sort are often used instead of rugs for doors, especially in China, while in the Alai basin the outside of the kibitkas is adorned with little pieces of coloured cloth sewed on to the felt at the base of the roof. The native artistic sense of the Khirghiz finds small opportunity for expression except in articles made of the two great products of the flocks—wool and leather.

Food and Habits of Eating.—As might be expected from their surroundings, the food of the Khirghiz is very limited in variety, and eaten in the rudest way. A typical meal, such as many at which I was a spectator, is likely to prove unpleasant to civilized nerves. One day, for example, I was on the floor in company with a ring of Khirghiz, who sat on the felts which covered all but the middle of the floor of a rich kibitka, when in came a man holding up the skirt of his gown full of dried dung. With this he kindled a pungently smoky fire on the stones which occupied the middle of the kibitka floor, and on the flameless conflagration put some tea to boil. When this was ready, the host took from the latticework of the kibitka a cloth heavy with grease and dirt, and spread it before me. After much discussion, a boy was benevolently sent to fetch me some milk or cream. While he was gone, a metal tray, containing small pieces of bread and sugar, was brought in and laid on the dirty cloth. The bread consisted of cubes, half an inch in diameter, cooked like doughnuts in hot fat at the bottom of an enormous iron bowl. Among the strictest nomads bread is a great rarity, and I have even had the pleasure of giving a piece to children who never tasted it before. After the tray was in place, some china bowls were taken from their nest in a round wooden box, and, having been wiped with another greasy cloth, were filled with tea. By the time this had become cool the boy returned with news that his quest had been successful. At his heels followed a fat Khirghiz housewife, who dived behind the ornamented screen of reeds on the right, and with a wooden ladle scooped almost solid cream from a large wooden bowl into a small china one, and then poured milk from a leather flask into another smaller wooden bowl. As she handed the milk and cream to one of the men, she saw that bread was needed on the tray. Kneeling before a red and green leather-covered box, she reached behind her heels for her silver-loaded bunch of keys, suspended from her long braid

of straight black hair, and, finding the proper key, took from its safe repository a handful of carefully treasured bread. Now the tea-drinking began, and it continued till the supply was exhausted. Each guest had had three or four bowls, but even that was not enough, so each one finished with a wooden bowl of "kumess," the fermented milk that still remains one of the most important articles of Khirghiz diet. Then when the servants had smacked their lips over the remains of the meal, each man, with a look to see that his neighbours were ready, raised his hands to his face, and all in unison stroked their beards, with a muttered benediction to Allah.

THE ERECTION OF A KHIRGHIZ KIBITKA AT A NEW ENCAMPMENT IN THE ALAI MOUNTAINS. THE WORK OF SETTING UP THE KIBITKAS IS ALWAYS DONE BY THE WOMEN.

During the next hour or two big stories of brave deeds and travel were told, or less praiseworthy talk of quarrels and women kept the party animated at first, but soon the kumess took effect, and drowsiness began to prevail. At length, to the relief of all, the host appeared, and we knew that the real meal was at hand, for the tea-drinking is, after all, but a new-fangled Russian notion. In his hand, at the end of a spit, he bore a small piece of roasted fat from the immense kidney-shaped tail of the sheep that we were to eat. Pulling his big knife from his girdle, he cut off a morsel and placed it in the mouth of each guest as an appetizer. Behind the host came his boy, bearing a basin and a copper urn of water, and in the oriental way poured water over the hands of one after another of the squatting circle, beginning, of course, with the

most honourable. As the Khirghiz put out their hands to wash, they made a peculiar gesture of throwing back the sleeves, which are made so long as to completely cover the hands and protect them from cold and wet.

Now all was ready for dinner, and in it came, an enormous quantity of boiled mutton in an enormous wooden bowl, flanked by two smaller wooden bowls full of the broth in which the meat was cooked. The host said, "Eat;" some one else said, "Eat;" and then each cross-legged Khirghiz cried, "Eat," and, whipping his knife from his girdle, seized a bone. The scene that followed was like the feeding of wild animals in a menagerie. Each man grasped a bone, and with his knife and teeth ripped off huge chunks of meat or fat, and with a mighty sucking and smacking drew them into his mouth. The daintiest portions, the head and liver, were offered to the elders of the feast, who skilfully gouged out an eye or yanked out a tongue. When the edge of appetite had been appeased with two or three pounds of meat and a pound or two of fat, most of the guests took a drink of soup, and then, with idly hanging greasy hands and greedy eyes, watched while the epicure cracked and sucked a bone, and one or two of the more skilful carvers prepared a delicate hash. The fat tail, which is really delicious, a selected portion of the liver, and a good supply of other fat and meat were most cleverly sliced into fine fragments and mixed with soup in the bottom of one of the bowls. When the mixture was ready, each man rolled up a handful and sucked it noisily into his widely distended mouth, or, as a mark of respect and affection, put it into the mouth of his neighbour. The meal was over in an incredibly short time—the last bones were cracked and thrown to the edge of the kibitka; bowls of soup, followed by those of kumess, were again passed around; the big top-boots were oiled by rubbing the greasy hands upon them; the beards were stroked; and the main business of life was over. Day after day the diet is the same, except that the amount of meat is less and of kumess more. For variety the mutton is occasionally fried or boiled in its own fat or roasted on a spit. Sometimes, too, a young colt is killed, and is eaten as the greatest of delicacies. The meat, the one time that I ate it, tasted like a cross between the best grades of veal and lamb, and was fit for the table of the most exacting epicure.

Hospitality.—Just as the Khirghiz habits of eating are the result of an environment which compels the people to live on animal food, so the character of their hospitality is the result of that same environment which isolates them, and at the same time compels them to travel. That the Khirghiz are hospitable need hardly be said. Pastoral people are always so. They live in a region where travellers are so few, and habitations so migratory, that special accommodations for wayfarers are out of the question. Yet the nomad himself, in his search for stray

cattle, in his business of exchanging animals, or in his rides between the summer camp and the winter supply of grass, must often spend the night far from home. Everywhere the people are in the habit of receiving guests, and the custom is to pay nothing for entertainment. Because of this the Khirghiz meets the traveller with less suspicion than does the less cosmopolitan villager who lives near a big city. When a stranger arrives, the customary greeting is to take off the cap, shake hands by clasping your host's right hand between both of yours, and lastly to stroke the beard. Often when a stranger passes by, men turn and accompany him on horseback for an hour or two,

A VILLAGE OF THE SEMI-NOMADIC KHIRGHIZ OF THE ALAI BASIN. THE FIELDS, IN WHICH LIE PILES OF GRAIN, ARE PARTIALLY SEPARATED BY WALLS OF MUD AND STONE. ON THE FLAT ROOFS OF THE MUD HOUSES STAND ENORMOUS STACKS OF HAY FOR WINTER USE. IN THE BACKGROUND ARE RIVER TERRACES OF GRAVEL.

to do him honour, and to get the news. The isolated life of the Khirghiz accounts for their eagerness in this latter respect, and the abundant leisure of the nomadic life accounts for the unconcern with which a man puts off his work for half a day. These chance encounters on the road are often most interesting. One day, as I was crossing the Jukuchak glacier south of Issik Kul, five men appeared on the ice above me, one mounted on an ox, one on a cow, and three on horses, with a loaded camel bringing up the rear. All these five strangers dismounted from their slipping animals and, walking across the treacherous ice, gravely shook hands with me. They certainly are a polite and friendly people. Whenever a guest mounts his horse,

the chief man present runs to assist him by seizing him under the shoulder and shoving him up. If the guest happens to be a foreigner who is so peculiar as to wish to have a whole kibitka to himself, a family will often move out, or rather they will let their kibitka be moved away from them. It is a strange sight to see a kibitka picked up bodily by a dozen men and women, who seize the lattice on the inside and, themselves invisible save for the many legs, carry the beetle-shaped tent across the greensward to a new clean spot. The household goods are left in a sorry heap, and the family has to find another house, but even for such service the more aristocratic people refuse to accept pay.

One other hospitable Khirghiz habit is a direct result of the nomadic life and the abundance of animals. On entering the main Tian Shan plateau, I found that each day fresh horses were brought for me and my men, and even for our baggage. At first I understood the servants to say that our horses were tired and needed rest, which was true, but when I offered to pay the hire of the supplementary horses I discovered my mistake. In these regions, it appears, the traveller is theoretically supposed to start from home and to return thither by the way that he went. The first day he rides his own horse, and at night turns it out to feed with those of his host. In the morning he does not take his own animal, but a fresh one from among those of his host. This he again leaves at night, and so on day after day. On the return journey he picks up at each place the horse that he left there and returns it to its owner. In practice the scheme is not so simple. In our case we were furnished daily with from six to ten horses belonging to various people at the camp where we had spent the night. At the end of the day's march, or occasionally in the middle of the day, we gave up the animals to one or two men who had come with us for the purpose of driving them back. For all this the people would take no pay whatever, though it was often offered. So freely does one man make use of another's horses that not infrequently when we passed a new herd, some one would say, "My horse is bad," and would dash off to catch another with a rope looped like a fishing-line to the end of a stick. I do not know how universal the custom is, but during our journey the changing of horses played so important a part that the stock remark was not about the weather, but "How is your 'animal' to-day? Has he a good gait?"

Khirghiz Sports.—The sports as well as labours of the Khirghiz result from the same physiographic conditions which induce nomadism. Horses and horseback riding are the one idea of these people, and their greatest sport is the "bagai." In the Alai valley, close to the border of Bokhara, I saw this interesting game. As we came down the hillside to the smooth plain, a crowd of distant horsemen seemed to be standing motionless, until one or two darted out, and the whole fifty or sixty dashed after them. Evidently they were chasing a leader in some game,

and the leader kept changing. Drawing nearer, we saw that two galloping horsemen had detached themselves from the crowd, and as they rode toward us were struggling for a large black object bigger than a sheep. Suddenly one of them threw his leg over this, gave it a jerk which nearly dismounted his rival, wheeled his horse to the left, and, dashing up to me, threw the thing at my horse's feet. It was a black calf, headless and footless, and partly skinned. At once three or four men who galloped up behind the leader, leaned from their moving horses and attempted to pick it up. Two grasped it, twenty or thirty others surrounded them, and all struggled to seize the calf and carry it

THE BAGAI, OR NATIONAL GAME OF THE KHIRGHIZ. IN THE CENTRE SIT TWO MEN, EACH OF WHOM HAS A LEG THROWN OVER THE ANIMAL FOR WHICH THE PLAYERS ARE STRUGGLING. IN THE BACKGROUND LIES THE TERRACED ALAI BASIN, BOUNDED BY THE LOWER SLOPES OF THE PAMIRS.

off. In the *mêlée*, the horses jumped and turned this way and that, while all the riders tried to force a way to the middle of the fight, whipping their own and other people's horses, grabbing horses by the head and turning them suddenly round, and themselves leaning far out of their saddles as they grabbed madly at the poor black calf. At last one man captured it, threw it over the front of his saddle, put both legs over it and was off at a dead run with fifty others after him. They could not catch him, and, making a great sweep as large as the terrace allowed, he returned in triumph to throw the beast before me and get the customary reward.

Then began another scrimmage, in which one over-zealous rider was

knocked from his horse and apparently trampled on, but when the kicking, surging crowd of horses had passed, his horse was still with him, and he mounted and galloped off with a grin. After half a dozen scrimmages, one daring rider seized the prize and went over the terrace down a hundred-foot slope so steep that a footman could scarcely climb it without zigzagging. At the foot the bold rider, hard pressed by his pursuers, cantered across a broad arm of the river, and away across the plain beyond, trying as he went to skin the calf, for he who carries off the skin wins the "bagai."

We rode away with the "Deyem Bai," the giver of the entertainment, who was homeward bound to inspect the cooking of the sheep for the feast that was to follow. It is the custom, I was told, for men of wealth to furnish a goat or calf for the "bagai," and to invite all the men of one or two villages to join in the sport, and at the end to indulge in a feast, or better, a carnivorous orgie. Among the occasions for a "bagai" are a marriage, the birth of a son, the erection of a new kibitka, and a death. Possibly this struggle for a dead animal is a relic of the time when the ancestors of the Khirghiz really fought to get the prey from one another. Whatever its origin, it is a wonderful training in horsemanship. For some reason, no woman is allowed to see the "bagai," or, naturally, to join in the subsequent feast.

The Nearness of the Khirghiz to Nature.—The completeness with which Khirghiz life and character are determined by natural surroundings, makes the relation between physiography and ontography far more evident than in the case of more highly civilized people. If the nomad is to be successful, the keenest of eyesight is necessary to detect cattle or encampments at a distance. It was with amazement that I heard my guide say, "Do you see those cattle off there at the foot of the mountain? They are Chinese animals—yaks." After a long search I found them, mere tiny specks of black, so far away that even with a strong field-glass I could but barely distinguish them from ordinary cattle. That my guide should recognize them as yaks shows a keenness of sight equal to that of the most skilful hunting tribes of savages. Other Khirghiz showed equal quickness in detecting smoke, kibitkas, men, and animals at a distance, so that the trait seems general.

His mode of life makes the Khirghiz able to endure hunger, thirst, and fatigue, for these are the necessary accompaniments of long rides in search of strayed cattle. He has no fear of raging fords or slippery passes, and despises the city Sart who shrinks from crossing a ford where his horse may lose his footing and be washed downstream. In such rough experiences the Khirghiz learns to be self-reliant, and his frequent meeting of strangers under all sorts of circumstances gives him an air of readiness and self-possession. The talk of the Khirghiz is full of roads and travels. If you ask a man how far it is to a certain place, he at once begins to tell you all the intermediate stages and their

difficulties. These people are full of the knowledge of their plateau that comes from experience, but book knowledge is very rare. As my escort, a proud influential Khirghiz, said one day, "Why should the Khirghiz learn to read? It is enough for us to know about sheep and horses and cattle. What more do we want?"

The Khirghiz and Civilization.—If there were no outside world with which to come in contact, such a view of life might perhaps be wise.

KHIRGHIZ WOMEN IN HOLIDAY ATTIRE STANDING BESIDE A KIBITKA, WHERE THEY ARE ABOUT TO MAKE A VISIT. ALAI MOUNTAINS.

As it is, the Khirghiz cannot stand against the hard realities of civilization. The coming of the Russians has done them an immense amount of good in making the country peaceful and safe, and in providing good markets for the products of the flocks. It has also added to their happiness by making such luxuries as tea, sugar, bread, and cheap cotton cloth accessible to all, but it will harm them if it leads them to abandon the pastoral life for that of the day labourer. The delightfully gentle and gracious courtesy of the Khirghiz cannot offset their laziness, if that term can properly be applied to a quality which

is a necessary outcome of the nomadic life. A nomad is justified in being often idle, for his great exertions at certain times compell him to rest at others, but the qualities so engendered are of no use when steady work is required day after day. Thus it comes to pass that those Khirghiz who have come into close contact with the Russians seem to be deteriorating. Laziness leads to dishonesty, and both tend to insolence and vulgarity. A change of habits, too, leads to greater uncleanliness, for customs that may be harmless where a camp is shifted every month or oftener, lead to filthiness where a kibitka stays for six months or a year in one place. Change is always difficult, and it is especially so for people like the Khirghiz, who have adapted themselves so completely to a type of physiographic conditions so unusual as those of the Tian Shan plateau.

The Position of Women.—Up to this point in our consideration of the ontography of the Turkestan mountains, the connection between life and physiographic environment, though not always direct, has at least been so close as to be clearly evident. We have seen that not only the outward habits of life, but also certain mental and moral qualities are due largely, if not entirely, to physical environment. In the short remainder of this article, I shall take up one or two among the many subjects where such a relation does not at first sight appear, although I am firmly convinced that it exists. In determining the mental and moral character of a people, no factor is more important than the position of women, and the resulting character of the homes in which the children grow up. If the position, and hence the character, of women is materially affected by physiographic environment, it follows that a host of other characteristics must be indirectly affected through the tremendous agency of the home, and of early training. I freely admit that religion, heredity, tradition, and perhaps other unknown factors play an immense part in determining the character of a race, but is it not possible that these, too, in their origin are largely the result of physical environment? With that, however, we are not now concerned. It will be enough, at present, to point out certain ways in which the physiography of the Tian Shan, working through the institutions of nomadic pastoralism, affects the position of women. If our conclusions are correct, all character is influenced, more or less, by physical environment, and hence is one of the integral subjects that go to make up geography.

Mahommedanism, as every one knows, inculcates the seclusion of women, and makes of her nothing but a stupid drudge to do man's work, or a light plaything for his pleasure. Wherever people of Muslim faith gather in towns and cities, as I have seen in Turkey, Persia, Asiatic Russia, and Chinese Turkestan, this ideal prevails. In the crowded villages and cities women can do their work behind high mud walls, and can be confined to certain unseen rooms when male

guests visit the house. The support of the family does not depend upon them, and their activities are almost wholly dependent on the will of their husbands. It is but rarely necessary that they should leave the house, and when they do, there is usually no work to be done and it is easy to keep their faces covered. Only the very poor, who must work out-of-doors, or those who are confessedly immoral, go about with unveiled faces. The evil effect of all this has been often described, and needs no comment.

Among nomads the case is different, and this is true, not only in one Mohammedan country, but, so far as I know, in all without respect to the race of the inhabitants. The women go about unveiled, and have a strong influence in the affairs of the community. Their relative strength of character is evident from the notable fact that when a Turkoman woman is married to a Persian, or a Kurdish woman to a Turk, the wife from the nomad stock, so it is said, usually rules the harem, and often rules the whole house. The universality of the contrast between the position of women in nomadic and non-nomadic Mohammedan populations goes to show that the contrast is not the product of racial differences, but of nomadism; and nomadism, as we have seen, is due to physiographic environment.

Let us see in brief how the nomadic life of the shepherds of Tian Shan affects the Khirghiz women. In the first place, the women cannot be kept in seclusion. The house of a nomad must of necessity be small, and cannot contain two rooms, except under the most exceptional circumstances. When a visitor comes to the tent, he must enter the room where the women are at work, or else the women must work outside, as indeed they must under any circumstances; and there, of course, they cannot be prevented from being seen by men other than those of their families. Then, again, at the time of migrations there are no shelters left standing, and the women cannot possibly be kept concealed. In the second place, the women cannot be made to veil their faces. No one can work with a cloth hanging down over her face. The village woman bakes and brews and washes, and milks her few sheep and goats in the seclusion of her own courtyard, where she can throw off her veil in the assurance that no strange man will see her. The nomad woman, as we have seen, must work in semi-publicity, and cannot be bothered with a troublesome veil, especially when both hands are more than occupied in milking some of her many sheep. Accordingly, while the Khirghiz woman is very particular about her head-dress, she makes no attempt to conceal her face. She is quite in the habit of meeting strangers, whether men or women, and she does it modestly, though without timidity. Indeed, she makes a most admirable hostess. Her freedom from seclusion does much, both morally and mentally, to elevate her above her less fortunate sisters of the villages.

Another side of nomadic life tends to strengthen the character of the women. They are obliged to rely more or less upon themselves, and to take the initiative at times. In their care of the flocks and herds, it often happens that the men are all far away throughout the whole day, and at certain times, when the grass must be cut in the valleys, many of them are away for several days. At such times the women are responsible for everything. I have come to an encampment of seven or eight tents where no one was left, except a few girls and one or two old women. The smaller girls, not unnaturally, were afraid of us; but the newly wedded wife of the chief man, a pretty girl of sixteen, entertained us most graciously, and by the time that her husband and the other men arrived had supper ready for them and us. A veiled village woman would merely have screamed and run away at our approach. Beside all this, the occupation of the men with the horses and larger animals leaves to the women the care of the sheep when the flocks are driven home at evening. And, lastly, it is always the wife who has the responsibility of taking down and packing the kibitka, and setting it up in a new place, while the men take care of the herds. All these differences between the women of Tian Shan and those of the villages are the direct results of nomadism, and all of them tend to make the Khirghiz wife stronger, more capable, and more self-reliant, and hence a better and more loving mother.

In view of all this, is it going too far to say that the relatively free, warm-hearted, and affectionate spirit shown by the Khirghiz in their relation to one another is, in part at least, a geographic fact, the result of the reaction between man and his surroundings? In Karategin, at the eastern corner of Bokhara, I had a most pleasant glimpse into the inside of a Khirghiz family. As we entered the village of Kichik Karamuk, I spied a villager making a rude sledge of the sort which the semi-agricultural Khirghiz use for hauling grain and hay, and which they style "arbas," or carts. Of course I wanted to photograph it, and told my servant Sherif to tell the carpenter to sit out farther into the light. Sherif, for some reason that I did not catch, said that it was impossible, but as another servant put the man in the right place, I took the picture before asking any questions. The sledge-maker proved to be Sherif's brother, whom he had not seen for seven years. Out of sheer politeness the brothers remained silent till the picture was finished, then they embraced one another gently, as wrestlers might clinch before a struggle, first on this side and then on that, repeating very often and very fast the greeting, "Salaamet, salaamet, salaamet" ("Peace to you, peace to you, peace to you"). Later I saw Sherif meet another brother, the oldest out of nine, and an older sister, who had been like a mother to him. The grey-bearded older man, who was some twenty years older than Sherif, literally fell on his brother's neck and wept. The story of the Prodigal Son seemed very real just then. Meanwhile the wet-

eyed sister stood silent till her turn came. As she fell on her brother's neck she wept aloud for a moment, and then, still clinging to him, began to chant a song of thanksgiving; and so she continued for some minutes, first weeping and then singing. Feeling out of place, I went into the kibitka and sat down on the floor. After me came a chubby little urchin of three, with a rosy dirty face and a single scanty garment. A vague idea possessed him that some one had come whom he must welcome, so with a charmingly friendly smile he came and put his fat arms round me.

Conclusion.—This sketch of the mountains of Turkestan, and of the living things that inhabit them, is very far from being complete. To outline the physiography of the region; to describe the old peneplain uplifted into a plateau and warped into basins and ridges; to give an account of the consequent drainage, the glaciers, and the steep-sided young valleys contrasting with the smooth slopes of the old peneplain; and, lastly, to so frame the glacial theory as to fit the old moraines and terraces that everywhere abound,—to do all this is comparatively easy. The way has already been mapped out and made plain, and the subject has a definite classification where each fact finds a place. It is in the newer half of geography, the science of ontography, with its study of the relations between the animate and the inanimate, that the greatest difficulties are met. To thoroughly understand the relations of plants and animals to their geographic surroundings, one needs to be a botanist and zoologist, as well as a physiographer. In the still further reaches of geography, the ontographic relations between man and physiography, the subject becomes at the same time more interesting and more difficult. We possess an immense body of facts, but they are scattered here and there, unmatched and unrelated. We have not even a definitely recognized scheme of classification in which a place can be found for every fact as it appears. I have tried to take some of the chief facts in the life and character of the Khirghiz, and to show how they are related to the physiographic facts of the Tian Shan plateau. Beginning with the grosser, more material aspects of life, it appears that the nomadic pastoralism of the Khirghiz is due to the climate and vegetation of the region that they inhabit. On this are dependent the form of their houses, furniture, utensils, and dress, which in turn lead up to and determine the nature of their art. Again, the food of the Khirghiz is narrowly limited by the nature of their occupations, and this in its turn controls the large body of habits that centre about the necessity of taking nourishment. Another line of thought leads from the frequent movements of the Khirghiz to the character of their hospitality and to their politeness. Once more the plainly ontographic facts of the hardships of the nomadic life result in certain mental and moral traits, such as bravery, hardihood, and, unfortunately, laziness. Lastly, the conditions of nomadic life

determine the position and character of the Khirghiz women, and lead to certain of the higher moral traits, such as morality in the stricter sense, self-reliance, and even family affection. Other equally important subjects, such as government and religion, have been purposely omitted. In every case the attempt has been to proceed from the inanimate facts of physiography to the animate but still purely material facts of ontography, and thence upward by one road or another to the mental, the æsthetic, and the moral. It may be that I shall seem to many to have laid too much stress on the influence of the purely physical, and to have neglected the something, whatever it is, that lies above and beyond the physical. In reply, I can only say that the latter lies beyond the province of geography. I have tried to draw attention to the *relationships* between all that goes to make up the earth and air of the mountains of Turkestan on the one hand, and all that makes up the life of that region, whether it be vegetable, animal, or human, on the other. And as far as those relations have been truly conceived, this paper contains a part of the geography of Turkestan.

SOUTH-WESTERN ABYSSINIA.*

By B. H. JESSEN, Engr. for W. N. McMillan's Expedition, 1904.

In the fall of 1903, Mr. W. N. McMillan, of St. Louis, Mo., U.S.A., organized an expedition which was to go through the Egyptian Sudan towards the districts lying north-west of Lake Rudolf—in other words, the south-western border of Abyssinia.

The object of the expedition was twofold, the main one being to explore as much as possible of the unknown countries lying between the Baro river at Itang and Lake Rudolf, and more especially to ascertain the topography of a mountain plateau called "Boma," lying directly south of the river Akobo in lat. 6° 35′ N., and long. 34° 30′ E. The secondary object was hunting, and, whenever possible, to collect birds and butterflies for the British Museum.

Without going into details, I will only say that the expedition members, consisting of eleven Europeans, thirty-two Somalies and Sudanese, and one Egyptian, were collected in Khartum in the middle of January, 1904, where two steam-launches, an oil-launch, and two big punts were waiting for them. A Sudan Government steamer towed the whole flotilla up the White Nile to the mouth of the Sobat river, then up the Sobat to Nasser, a total distance of 712 miles from Khartum. At Nasser the Government steamer returned, and the expedition proceeded in their own boats up the Sobat and Baro rivers as far as Gambela, in Abyssinia.

As these rivers have been thoroughly described by previous travellers, I will but say that, as at the time of the year when we went up

* Map, p. 244.

(February and March) the water in the rivers was low and it was generally admitted that navigation was impossible, it may be interesting to learn that, with the exception of the ordinary difficulties met with in low-river navigation, and lack of fuel, we found no difficulty in getting as far as Gambela, the furthest point ever reached on this river, even at high flood.

The draft of our deepest-going boat was 30 inches. On April 27, the expedition proper started overland south from a place called Pokum,

A BOMA GIRL SELLING MAIZE FOR MEAT.

on the Baro river, some 10 miles east of Itang—a Sudan military post in Abyssinian territory. As the first 50 miles of the country traversed have been previously described by the late Italian Captain Bòttego, I will omit it here, and will only add that all of the country lying between the Baro and Akobo rivers is at present considered Abyssinian territory. After three days' march, however, through flat well-wooded country, following Captain Bòttego's route, we came to a river called Gelo, about which I will make a few remarks, as a statement made by Bòttego regarding a point on it was found to be incorrect.

On all maps of this district, the river Gelo is shown to run through a small lake called Tata. On making a rough survey of the river, I found that the lake is an overflow lake from the river Gelo, which runs half a mile south of it, as shown on the maps attached hereto.

From this point on, we started to go through unsurveyed country, going up the course of the Gelo river eastwards, towards the Abyssinian highlands for about 20 miles, and then south to the Akobo river. The country was of a gently rolling nature, well wooded and covered with grass, which in places became almost impenetrable. Along the river we met with swamps or large plains with coarse grass from 10 to 12 feet high, impossible to go through at that time of the year (May). However, we followed a native path going from village to village, and on the whole found little difficulty in making from 2½ to 3 miles per hour.

With regard to the forests, they were, as a rule, of a park-like appearance, and with the exception of groves along the river-bank, the trees seldom attained a greater height than 50 feet in this particular district. Along the river, however, some of the trees assumed an enormous height and girth, and the vegetation was of a dense tropical nature, creepers and palms of many varieties giving the landscape a most beautiful appearance. The river itself was the most tortuous I have ever seen, in many places doubling upon itself in such a manner that one could throw a stone over the narrow slip of land which divided one part of it from the other. In the rainy season parts of the surrounding land becomes inundated, and although the river-bed showed no sign of having undergone any recent change, it undoubtedly undergoes many quite marked ones, which, on account of the deep soft soil and the luxuriant tropical growth, becomes completely obliterated in the course of a single season.

The Gelo river has its source among the southern Abyssinian mountains, and runs to the north of the mountainous district of Gurafarda, where it descends to the lowlands, and then winding its course westward until it joins the Pibor river, which is a tributary of the river Sobat. Its total length is about 200 miles, and as it is the main watercourse in these districts, it is of some importance. In flood it assumes quite large proportions, being from 80 to 100 yards wide in places, with a depth of about 20 feet. The river abounds with fish, and as a natural consequence the crocodiles are very numerous and large. At midday practically every sandbank is covered with them. It is a remarkable fact that the hippopotami are conspicuous by their absence, only one having been seen and killed many years ago, as these animals are plentiful everywhere else in these countries.

The forests in the immediate neighbourhood of the river teem with animal life. Elephants, giraffes, buffaloes, various antelopes and gazelles, wort-hog, wild pigs, lions, leopards, hyenas, jackals, wild cats, monkeys, etc., may be met with at any time. The elephants assume an

enormous size, one which a member of our party succeeded in killing having tusks weighing 110 and 108 lbs. respectively.

The bird life was not so prolific as might be expected; very few waterfowl or cranes were seen along the river, and in the forests paraquets, pigeons, doves, some quail and partridges, vultures, hawks, and some beautifully coloured small birds, were all we saw. The country swarms with insects, especially ants of every possible kind.

PARK LAND.

Regarding the inhabitants of these regions, they belong to the Anuak tribe of people, about whom I believe something has been written before by the emissaries of the Sudan Government. On a trip like ours, where short stays only were made at any place, it could not be expected that any thorough knowledge of the people could be gained, so much the more so as until our arrival they were unacquainted with Europeans. On the whole, they were a healthy-looking race, the men nearly all being 6 feet in height, of a slender muscular build, with features of a refined negro type, the thick lips and flat nose being the exception

rather than the rule. But it seemed to be the custom for the men to have the front teeth in their lower jaw extracted. After gaining their confidence through presents and letting them understand that we were peacefully inclined, they would gather together about our camp, squat down and talk and laugh like children until sundown, when they all would go back to their villages, and would not return again until sunrise the next morning.

They were very fond of bright ornaments, such as brass, tin, iron, and ivory. Some of the men had their arms covered with brass rings from the wrist to the elbow, and a huge ivory armlet around the upper arm, making them perfectly useless for any kind of work.

It was an amusing sight, after we had been a few days in camp, to find some boys with the lids of sardine or biscuit tins tied around their necks, or a sardine-tin opener stuck through their ears, while the women would gather up the used soda sparklets and make necklaces of them.

With regard to their religion, they are utterly heathen, having only the faintest idea of a Supreme Being, and at the same time being in dread of evil spirits, which they believe to be prowling about at night.

The nearest mission station to these people seems to be an American one, about 250 miles westward on the Sobat river, and as this mission evidently have their hands full with a tribe of people called Nuers, the Anuaks are still utterly ignorant of our religious beliefs. They are pliable, however, and I believe could be easily taught.

With regard to their government, they are all supposed to be under some Abyssinian "Ras," to whom they must pay a yearly tribute, either in ivory, labour, or grain. Directly they are ruled by their own chiefs, or "shaums," whose power is absolute; when a chief dies, his son becomes chief in his place, thus proving the power invested in them to be hereditary. Each chief has his sub-chiefs ruling over outlying villages and districts, who must pay some yearly tribute to the head chief.

All the members of a tribe are not equally well off, there being rich men and poor, just as in a civilized community, the rich men being invariably the headmen or supporters of the chiefs. We noticed cases where some men would come to us and beg for something to eat, while the well-to-do men in the tribe would have hundreds of sheep grazing around. It seems, then, that they have a strict system of government, and that personal property is respected among them. This may, of course, easily be accounted for when we consider their close proximity to Abyssinia and the Sudan.

There is no doubt that these people, who, sad to say, are gradually becoming extinct, are greatly influenced by their surroundings and the peculiar circumstances in which they are placed. Shut in on one side by the giant Abyssinian mountains, and on the other by the warlike and ever-aggressive Nuer tribes, their existence is not much better than that

of the flying fish. The Abyssinians, though officially their protectors, make yearly raids on them, ostensibly to collect their tributes, but incidentally taking away boys or women for slaves. This, however, may not be officially known by King Menelik. The Nuers on the other side make inroads on their land, in order to gain larger pasture-grounds for their cattle. Being a peaceful people, almost entirely agricultural in their habits, and only having rude spears for protection, they are

VIEW NORTH FROM BOMA.

almost invariably subdued, and consequently it will only be a matter of a few years before the whole tribe will be swallowed up and divided among the Abyssinians and the Nuers.

Their chief industry, as before mentioned, is agriculture, comparatively few cattle, sheep, or goats being raised, evidently because of the great death rate caused among all domestic animals by a certain kind of fly. On the expedition we had with us 220 mules, ponies, and donkeys, of which only about 60 came back alive after a three months' trip through this country. Chickens seemed plentiful, but they were of a small inferior kind.

The Anuaks are not very numerous. As to their number, I would not like to give any definite figure. They almost invariably have their villages alongside some watercourse. Their huts are built of wood framework covered with straw, and consist of one room only. They are not very cleanly, as they have a great liking for smearing themselves with fat or castor oil. This latter plant can be seen growing round every village. Their staple food is maize or durra, and as the soil is excellent, the crops are magnificent, and are raised with a minimum of labour. The whole tribe, men and women, assist in working the fields, and in order to protect the crops against the ravages of swarms of small birds, which come round just before harvest time, they erect look-out towers, on which the women and children are posted with a plentiful supply of mud, which they throw by means of long supple sticks into the cornfields, shouting at the same time to frighten the small marauders away—surely an arduous task in such a hot sun. They have many other kinds of scarecrows, but the above seems to be the one most in use. The corn is ground in the most primitive manner, between two stones, and is, of course, assigned to the women. Of vegetables, they have a kind of pumpkin, a large overgrown cucumber, some wild yams, beans, and a plant which looks like a four-leaf clover with a yellow flower, the name of which I did not get. Of fruit trees they have none, except the doleb and dom palms and a very few date palms.

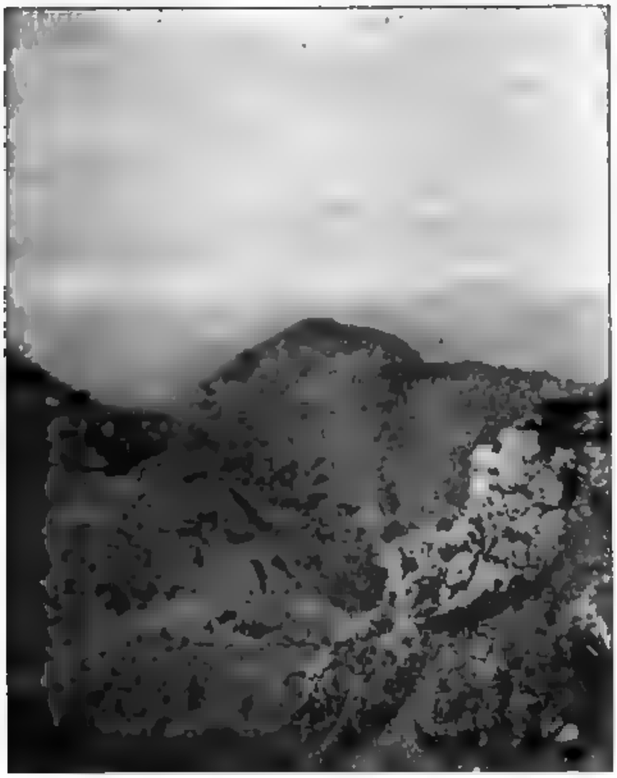
The land is cultivated only sufficiently for their own consumption. In bad years, or when raiding parties have been around, they very often have to live on wild roots or whatever they can manage to trap. Although the woods are full of game, they do not seem to know much about catching any, and they were highly gratified when we killed something for them. I saw some rude trapping implements, but they seemed to have been in long disuse. As a rule, no clothing is used by the men, and only a small piece of dried skin by the married women. Boys and girls go about in nature's garb.

As to their language, I can say little about it, not knowing enough Arabic, Nuer, Galla, or Abyssinian—the neighbouring languages—to make a comparison; but they evidently speak a language of their own, as none of our men could understand a word of what they said in the beginning.

Along the Gelo river these people are ruled over by a sheik called Shama, residing in a village by the name of Gog. The tribe was here fairly numerous and very friendly. When we asked for porters to carry some of our boxes, we secured 382 men without any trouble from Sheik Shama. These porters carried our things for four days to the Akobo river, a distance of about 40 miles, whereupon they returned to their villages. They were paid in beads, brass wire, calico, or Maria Theresa dollars, the only coin which they seemed to understand, this being the current coin of Abyssinia. Polygamy is practised everywhere,

and their mode of marriage seemed to consist in exchanging a woman for money, beads, wire, or, wherever possible, cattle.

The climate, though warm, was not unbearable, the thermometer seldom exceeding 100° in the shade after leaving the Baro river. When going through the country between the Baro and Akobo rivers in May, we had only a few rain-showers, and consequently the going was excellent, in spite of the flat nature of the land. On returning in June, however, the whole aspect of things had changed, heavy showers



VIEW FROM TOP OF CENTRAL PEAK.

having practically inundated the country for miles around, and at times we had to ride through water reaching to the waist, while the clayey nature of the soil would make the going exceedingly heavy.

As the attached maps will show, we crossed several new water-courses between the Gelo and Akobo, none of which, however, were large. The river Agogotok, which was the largest, is undoubtedly the river Owag, marked on Major Austin's map, but it seems to have its source among the swamps and lowlands around the district we traversed rather than in the Abyssinian mountains, as at the place we crossed it in May

it had hardly any current, and was surrounded by swamps and pools. No habitations of a permanent character were found in this district, only a fairly good path leading from the Gelo to the Akobo rivers.

With regard to the Akobo river, it has been described by Major Austin, as far as its junction with the Ajuba river, and from there on, almost to its source, by the late Captain Bòttego.

Where we camped near the Akobo river in May, we made a few discoveries which will change the present maps somewhat. In the first place, the river which Captain Bòttego calls Chiarini, is called by the natives Akula. It is a small stream from 5 to 15 yards wide, with steep banks, containing pale blueish water with a good current. It has its source in the Gurafarda mountains, from where it runs westward to the north of Mount Ungwala, and joins the Akobo river at a place called Digira. We found that it had one tributary close to our camp, with water in pools only in May, called Ogero. On Major Austin's map, the river Akula is shown to run into the Akobo to the south of a village called Kenna, but on investigation, this was found to be an overflow kor only from the rivers Akobo, Akula, and the swamps between these rivers. I must, however, add that it is exceedingly difficult to distinguish kors, overflows, etc., from real river-beds in these districts, as the rainy season, on account of the flat state of the country, plays havoc with the soil generally, and at times forms channels from river to river which are very misleading. The country to the south of the Akobo river is flat, and although covered with open woods, it is swampy, and, according to native information, almost inundated in the rainy season. A few miles east of Mount Ungwala, Mr. McMillan found a small lake, between Lakes Garner and Bright, named by Major Austin, which we called Lake Lucie. The village of Digira, which lies on a point formed between the rivers Akobo and Akula, and most of the country eastward along the Akobo river as far as its junction with the Ajuba, seemed to be under the rule of Sheik Olimi. This man is the son of the sheik who was supposed to have been killed by Captain Bòttego's men some years ago, and for that reason he was at first chary about letting us have any of his men. However, we succeeded in getting some, but found that he really did not have many men, the Abyssinians having been in the district within the last two months on a punitive expedition.

From the junction between the Akobo and Ajuba rivers, the Akobo comes from an easterly direction, and as Captain Bòttego went on the south side of the river, and we on the north, we again went through practically unsurveyed country, where we found a few villages and watercourses not seen before. The country now began to assume a mountainous character, and while the vegetation remained about the same the population thinned out quickly as we approached nearer the Abyssinian mountains.

The last village which we saw was called Olam, and as a raiding party from the east had gone through this district recently, we only found a few old men in the village. They told us that there were two more villages further east, and that the people living in them were called Olamis, but that they spoke the Yambo language. From this point on we struck south, crossing the Akobo river, which was still a good stream from 30 to 80 yards wide, with swift-flowing water about 3 to 10 feet deep in places. We now entered upon wholly unsurveyed country, one

CASTLE ROCK, BOMA.

of our objects being to find out the source of a tributary of the Akobo, called Kaia (see map, p. 244). The country in front of us was at first excellent undulating grass land with open woods, and here and there a hill or mountain. Contrary to the assertions made by the natives to the north of the Akobo, we found lots of game everywhere, the giraffe being especially plentiful. As we advanced, the mountains became more numerous, and the ground, which at first was composed of good soft soil, became strewn with stones and boulders of every size. As the grass was long, and there being, of course, no path, we had

great difficulty in getting our pack-animals through, and I may add that it was only owing to our animals being specially picked mules and donkeys that we were able to get along at all. A camel caravan would inevitably become stranded among these mountains. We struggled on southwards for five days, when we reached a large mountain plateau on the north side of a peak, which we called Central peak, owing to its position on our map. All along we had either been following the Kaia river or been within sight of it. We found it to be a small stream with well-defined banks, containing little water only in June, but it showed evidence of assuming quite large proportions in the rainy season. It may be assumed that it has running water the whole year round, and for that reason it would be of value should any party choose to take this road down towards Lake Rudolf. It has its source partly from Central peak and partly from the mountains to the east, from which the river Sacchi flows south into Lake Rudolf, and thus water can be had all along the route. The plateau north of Central peak, lying as it did 3800 feet above the sea, was a most delightful spot, the climate being excellent, with a temperature during our stay ranging between 60° and 85°. The plain itself (which we called Zebra plain, extending over about 150 square miles) was covered with a luxuriant growth of fine grass, which was about waist-deep at that time of the year (June). Mimosas, acacias, and different varieties of small well-rounded trees were scattered all over, while grass-clad hills and rocky protuberances lent a charm to the scenery which was irresistible. To the south, Central peak reared its head 5200 feet above the sea, clothed with pale-green grass to the very top. Game was so plentiful that wherever we went we met with herds of giraffe, Jackson hartebeest and zebra, and some ostrich. In the middle of the plain the enormous white skull of an elephant was lying like a monument, thus proving that these monarchs of the forests have paid this marvellous spot a visit many years ago. A more beautiful place for sport, or as a health resort, could hardly be imagined.

We ascended Central peak, and had a most wonderful view of the whole country for many miles around. To the south-east, about 40 miles distant, Mount Naita reared its sharp-peaked head some 7300 feet into the sky. Between it and us a broken and almost impassable mountain plateau lay before us. This continued to the east as far as we could see, and to the west as far as Boma. Thus we saw at one view the whole of the country enclosed between the routes taken by Major Austin to the west and Captain Bòttego to the east, and decided to go no further.

The whole of this country is volcanic, and almost entirely uninhabited. We found a few huts among a clump of trees, which had been long deserted, and only once did we have a visit from a couple of poor half-starved looking blacks. One of these had a most murderous-looking

weapon round his wrist, consisting of an iron bracelet bent out and formed into an arrow-point underneath. They wore no clothes, and spoke a language which we could not understand. They pointed towards the north, indicating where their village was, and as we saw smoke ascending from among the mountains in that direction, we concluded there was a small tribe living there. Further east, at the foot of the mountains from which the rivers Sacchi and Kaia flow, there are, according to Bòttego, several villages, and the land is partly cultivated.

We went a few miles south of Central peak, but found the country so completely torn up that, on account of our pack-animals, we decided to strike about north-west towards Boma. After a day's journey, during which both men and animals suffered severe hardships on account of the rough ground, we got out on a rolling mountain plateau covered with scattered trees and grass, and with more even ground than we had had for many days. In places we came across large fig-bearing rubber trees and some dom and date palms among patches of ground which showed evidences of having been cultivated years ago. No signs of any huts were found, however. After four days' marching, we came to a district well populated and highly cultivated, which the natives called Boma. Major Austin went through this country some years ago, but did not succeed in getting into close contact with the natives. In this respect we were more fortunate, as, after proving to them that our intentions were peaceful and friendly, they very quickly got over their fear and gathered around our camp, which we made on the top of a rocky spur running into the mountain ranges to the south. The country itself was of a most peculiar character, and the scenery was very beautiful. The rock formations were very curious and imposing, some huge rocks rising vertically out of the plain to a height of several hundred feet. To the south, a range of mountains 5000 to 6000 feet high formed a kind of half-circle around the plateau over which we had been travelling. Far to the east Central peak was plainly visible, and to the north the dark and imposing Abyssinian mountains loomed up in the grey distance. To the west and right round us, fantastic jagged rocks and hills gave us a broken view of apparently endless plains covered with forests, which would open up and show us glimpses of green fields in places. Down among the hills and around the huge granite rocks these strange people had their villages and plantations. Some villages were nestling on green spots high up among the mountains like birds' nests, while others would only give us an indication of their existence by little ribbons of smoke curling lazily up into the blue sky from the forests. Numerous valleys and watercourses gave variety and a peculiar character to the scenery, while the park-like appearance of the woods, the absence of flies, and the fresh cool air made the place a perfect paradise.

The people living in this mountain fastness were strong, tall, and handsome, and seemed to be a much superior race to the Yamboes. They

were fearless and most decided in their manners, though suspicious of any sign of hostility. Most of the men wore a piece of skin in front of them from some wild animal or another, loosely slung by a piece of string over one shoulder. They must be good hunters, as they had skins of giraffe, zebra, and various kinds of antelope. They seemed to have no domestic animals, except goats, and lived chiefly on agriculture. Better durra or cornfields I have never seen anywhere, and they seemed to cultivate every available spot. Villages and cultivated fields were hidden away in the most romantic spots among the corners and cracks of the mountains. The condition of the crops was bountiful in the extreme, and where they could find people enough to consume such quantities of grain was a mystery. However, in trying to secure a guide in a lonely spot near a small durra-field with only one hut visible, we were astonished to find ourselves confronted with a score of handsome-looking warriors, all fully armed, appearing in a moment as if risen from the ground. We had evidently been watched and followed the whole way, and apparently had a lot to learn about the mysterious ways and means of the people of Boma. They were armed with two kinds of spears—a long one and a short one—and some of them had the same murderous wrist weapon which we had seen on a native at Central peak. As to their language, we learned some fifty words of it. It seemed to be peculiarly their own, and did not resemble the Yambo, Galla, or Abyssinian. They can only count to ten, and only a few of them were able to give me their names on that many figures. They are fond of ornaments, and wear a broad band of red beads, with a white stripe down the centre around their forehead, giving them a peculiar warlike appearance. Some of them appeared at the camp in all their war-finery, painted and feathered, and looking like demons, but never at any time did they prove unfriendly to us. They seemed to have a sort of stronghold on top of a mountain, 4000 feet high, to the south of us, as they stopped the writer when attempting to go up to the top in order to get some bearings. I took some photographs of these people, from which one gets a good idea of them. I believe these were the first and only pictures taken of this tribe. As to their number, government, religion, etc., I am unable to say anything, as we did not stay among them more than a couple of days: the food-supply for our men was running short. We bought maize enough from them for four days' rations, but after that they refused to sell us any more, as we could not give them salt, the only thing they seemed to want. The Abyssinian influence does not seem to extend to these regions as yet.

Among these hills several rivers have their source, such as the Ajuba, Chilimun, Neubari, and probably the Pibor. This latter, however, is to be investigated next year, and I may add that at present I am taking a course of instruction from the Society's instructor, in order to perfect myself for this work.

With regard to the Ajuba river, we found a small discrepancy between Major Austin's map and our own. The Neubari has a branch which starts from a point among these hills, which Major Austin has marked down as practically the starting-point of the Ajuba river. The mistake is unimportant, however, as both rivers are small and of no consequence. The Ajuba river is nothing more than a mud ditch, having water in pools only in June. Elephants and other game are plentiful on the west bank.

The next part of our journey was to the north, on the western side of the Ajuba river, and as Major Austin went south on the eastern side of the same river some years ago and gave a very good description of the whole country, there is little more to be said about it, as we did not find any habitations from the time we left Boma until we reached the Akobo river again. This journey took us four days, and went through rolling grass and wood-covered country along a row of hills skirting the Ajuba and Akobo rivers. The country was everywhere of a volcanic nature. Here and there we would find a pile of granite rocks piled up in artistic disorder, but as a rule all the rocks were lava. The soil was splendid, and around Boma I have no doubt that both coffee and tea could be grown, only the place is so far away from any market at present that it would be useless for settlers. An inferior kind of tobacco is grown everywhere, which the natives crush, dry, and mix with ashes and other ingredients, whereupon it is made into the shape of a sugar-loaf. Cotton was seen growing wild in places, and there is no doubt that by cultivation it might be made a paying industry. On the whole, however, the erratic climate does not seem to offer any good inducements for any one to try and develop this particular part of the Sudan or Abyssinia. As the observations made by this expedition unfortunately were very limited, it is possible that closer investigations will show riches of soil and minerals which our casual survey overlooked.

To conclude, taking a general view of the whole of the country which we traversed, I will say, that with regard to a commercial waterway or connection between Abyssinia and the Sudan, the Baro and Sobat rivers seem to be by far the most promising, as they are navigable in specially built boats the whole year round, as far as Gambela, a small place lying at the western foot of the Abyssinian highlands, and only some 30 miles from Gore in Abyssinia, a town which seems to be the main western trading centre in that country. The country around Gore is excellent, both for agriculture and cattle raising.

If the Sudan military post at Itang could be removed to Gambela, it would no doubt be the foundation of a very profitable trade between the two countries, Itang being too far removed, and the road to it from Gore too difficult, to induce the Abyssinians to undertake the journey.

NOTES ON AN IRISH LAKE DISTRICT.

By O. J. R. HOWARTH.

In September of 1904 I intended, while travelling in Connemara and the south of the county Mayo, to make soundings in certain of the small loughs west of Lough Corrib and Lough Mask. Owing mainly to the prevalence of high winds, I was unable to carry out my programme fully, but I have thought my few observations might be recorded in view of any future organized work in this district.

My soundings were made along sections between defined points, and have been plotted on the 6-inch Ordnance map. I went prepared to sound, photograph, and compile notes on the structure of the lake-basins. My sounding-lines were similar to those used by Dr. Mill and Mr. Heawood in the English Lake District, and the lead weighed 4½ lbs. I had covered it with a netting of tarred cord, with a view of minimizing the risk of damaging the paint of boats; this had the unanticipated result that the lead nearly always came up coated with the sediment of the bottom.

For the purpose of the few general notes which follow, the northern, southern, and western boundaries of my district may be taken respectively as Clew bay, Galway bay, and the coast between these inlets. This is perhaps the most striking portion of the western lake region of Ireland. From the south shore of Clew bay rises the isolated quartzite cone of Croagh Patrick, 2510 feet in height. A gently undulating area of bog, with a few small loughs, extends south from it to the Mweelrea and Sheefry groups. These are of various Silurian rocks, and separated by the Bundorragha river, draining Loughs Cunnel, Glencullin, Dhulough, and Finn, south to the Killary harbour, a fine hill-bound inlet of the Atlantic. Evidence of glacial work is abundant in the moraines along the Killary and in the striated rocks about Dhulough. South again the bogs reappear, and then from their midst the Twelve Pins or Bens rise sharply like an island, bold quartzite hills reaching 2556 feet of altitude. A chain of considerable loughs, Inagh, Derryclare, and Ballynahinch, winds about their base on the east and south; westward they sink more gently to the sea. The eye travels south from them towards Galway bay over a remarkable boggy tract sown with small loughs, the connections of which are largely below the surface. A few low hills appear towards the bay. East of the Pins (the bog intervening) the quartzite Maamturks and Corkogemores extend towards Lough Corrib, and east of the Killary are the table-topped Partry mountains and other hills extending to Lough Mask.

The lakes of this district seem to fall into two broad divisions, which may be called bog-loughs and mountain-loughs. The first class, of which the largest examples are the Inagh-Ballynahinch chain, are

irregular of outline, studded with islands when of any great extent, and obviously shallow, with flat or gently sloping shores. In this class a subdivision must be made, for the lakes of which the Ballynahinch chain are examples really occupy the boggy bottoms of broad valleys between hills, while the innumerable little loughs in the south-west of the country are merely pools in the plain bog occupying no defined valleys. The only examples of mountain-loughs exceeding a mile in length are Dhulough, Nafooey, Fee, and Kylemore. Of these, Dhulough I have already located; Nafooey lies among the hills east of the Killary; Fee is rather over a mile south of the Killary, and Kylemore lies south-west of this, between the Pins and Leamnahaltia mountain. Islands (other than mere rocks), where occurring in all the loughs, are thickly covered with stunted trees and shrubs, and the same is true in a modified degree of a peninsula on the north shore of Lough Fee and two on the south shore of Nafooey; whereas wood is almost wholly wanting elsewhere in this district, except in rare artificial plantations. My soundings are confined to Dhulough, Glencullin, and Nafooey.

Dhulough, which lies north-west and south-east, is 1 mile 1470 yards in length. It is oblong, and its extreme breadth of 800 yards is found in the upper part, but two-thirds of the distance down it narrows to 800 feet by the incidence of two rocky points opposite one another. East and west the hills fall sharply into it, the slope easing very slightly, and there is no beach except in one or two small bays. At the upper end there are beaches of very small rock fragments, and a short stream falls in from Lough Glencullin, about 230 yards distant in a straight line. The surface levels by the Ordnance map, from calculations in November, 1896, are, of Dhulough 108·5 feet, and of Glencullin 128·2 feet, but a former calculation made the latter figure 136. I was told that the level varied greatly. I dare say the eastern flank of Mweelrea is exceptionally rainy, as the mountain directly faces the sea, and from the midst of a storm at Dhulough, with a westerly wind, I often saw clear sky to the north.

At the lower end of Dhulough the shore is low, for the Bundorragha river flows out and the Glenummera enters from a valley between the Sheefry mountains and Ben Creggan. The beach here is sandy. On the east side the shore-line is partly artificial, being built up to carry a road. Besides the streams mentioned, a minor one enters the lough at the north-west corner from the fine cliff-bound glen under Ben Lugmore, where a bog obviously occupies the bed of a drained tarn; and several fall in from the Sheefry, which has many springs. In the north-eastern angle is an island, which is omitted in the 1901 revision of the 6-inch Ordnance map.

The name Dhulough signifies black lake, and from the hills the water has a curiously dark appearance. As in all these loughs, it is not

clear, and bubbles brown under the oar. There is very little vegetation in the lough. The bottom I found to consist of a dark-brown grit or disintegrated peaty matter, with one notable exception, for at the sounding of 121 feet on the west side towards the middle the lead brought up a fine bright yellow slime. The line of greatest depths, indicated by the broken line on the map (Fig. I.), appears to swing regularly towards the steeper shore. The sections (Fig. II.) reveal a continuation of the sharp slope of the hills, with a tendency, best marked at the southern end, to an almost flat floor at depths about 100 feet. The deepest soundings (164 and 150 feet) fell naturally about the middle of the upper and wider part of the lough. No considerable shallow bank was observed except at the north-western corner, where one is formed, I think, by the deposits of the torrent from Ben Lugmore. The two main streams entering the lough, namely, that from Glencullin and the Glenummera, form no deltas or shallows. The Glencullin stream is cleared by its course through that lough, while the Glenummera comes down through a flat-floored valley, and enters Dhulough by a deep quiet channel several hundred yards in length. There are, it is true, slight banks of sand to right and left of its mouth, but the first sounding marked from the point A (Fig. I.) outward was 61 feet.

Lough Glencullin lies west-north-west and east-south-east, is about 1340 yards in length, and nearly 600 yards in extreme width. It differs greatly from Dhulough; in fact, here, I think, the two types of bog-lough and mountain-lough exist side by side. The form is irregular, two considerable bays occurring at the lower end. The main stream enters at the top through a deep and tortuous channel, having descended from Lough Cullen in a series of cascades. An offshoot of the stream from the glen under Ben Lugmore runs into the southern bay. There are two islands in the lough, and a considerable bed of tall reeds at the upper end. The shores are either boggy or rocky, but a slight beach of small fragments occurs at the upper end. Although my soundings were made only on two sections in the upper part, I see no reason to suppose, from the general appearance of the lough, that any depth greatly exceeding my deepest sounding of 27 feet would be found elsewhere.

Lough Nafooey lies almost exactly west and east at an elevation by the ordnance survey of 93·7 feet. It is about 100 feet over 2½ miles in length, and about 50 feet over half a mile in extreme width. Abrupt flat-topped hills flank the straight valley of which it occupies part to north and south, reaching 1800 to 2000 feet on the north, and 1500 to 1900 feet on the south. The lough is oblong and rather regular in form, except that the southern shore is broken in the lower and wider half by one considerable peninsula, with a rocky island off it, and by one smaller one (at the point C in the diagram, this projection being a slight elevation almost insulated by marshy ground).

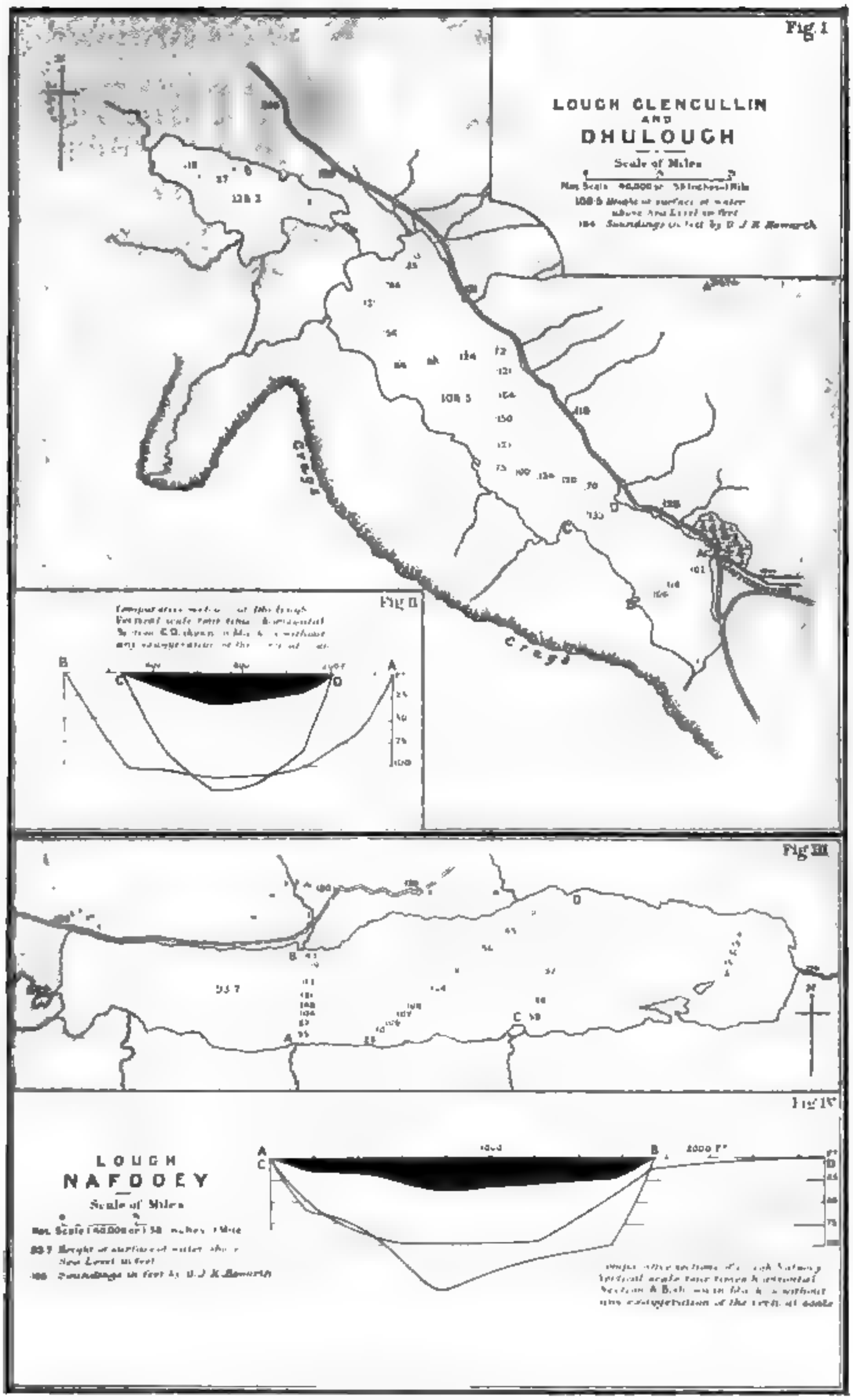


Fig I
LOUGH GLENCULLIN
AND
DHULOUGH
Scale of Miles
Crags
Crags
Fig II
Fig III
Fig IV
LOUGH
NAFOOEY
Scale of Miles

Most of the south shore is bordered by a patch of igneous rocks in the midst of the Silurian. Striated rocks show an ice-flow approximating to a line down the existing valley. The Owenbwee or Fooey river enters at the head through a flat alluvial valley, another smaller stream comes down from the south-west in a pretty cascade and enters close by, and a third stream enters from a considerable glen just below the south-western corner. The only other streams of consequence entering the lough are two on the north side. The river Finny flows out at the foot through a boggy valley to Lough Mask. At the upper end there is an extensive beach of fine sand, and a similar but slighter one about the mouth of the eastern stream on the north side; elsewhere the slight beaches which occur are of rocky fragments. The flanks of the igneous hills on the south are strewn with large detached boulders, a number of which have fallen into the lough, forming, off the shore between the peninsulas, a regular line of reefs, with deep water round them. As far as my soundings went west of the large peninsula, the deepest part of the trough and the sharper slope is on the south side, which accords with the relative slope of the flanking hills. At the upper end, however, I expect the case would be opposite. My deepest sounding was 148 feet in my uppermost section, but I anticipated deeper water above. On the lower sections the floor of the trough appeared almost flat, as in Dhulough.

I have alluded to the sandy beaches at the head and on the north shore of the lough. The main stream through the alluvial valley at the head flows over a sandy bed, but how far the sandbank continues beneath the surface of the lake I am of course ignorant. Such a bank is, however, exceedingly well developed off, and mainly east of, the eastern stream on the north side. Here a depth of only 12 feet was found 300 yards from the shore, after which the slope becomes sudden; it may be even more sudden than the section indicates, for this was one of the interesting questions which came before us and had to be left uninvestigated. Another was that the western stream, from an immediately adjacent glen, brings down no such deposit, although rapid and of considerable volume; its mouth is rocky, and there is practically no shoal water off it.

I am indebted to Mr. E. Heawood for his practical interest in this work both before and after its execution.

LIEUT. BOYD ALEXANDER'S EXPEDITION THROUGH NIGERIA.*

The following communication has been received by the Secretary from Lieut. Boyd Alexander; it is dated "Lake Chad, October 30, 1904:"—

"A good deal has happened since I last wrote to you from Lokoja

* See *Journal*, vol. 24, p. 589. Since the above letter was written, the regrettable news of Capt. Claud Alexander's death has been received.

in July last. No doubt you will be interested to have a rough outline of our progress and what has been done since the expedition left Ibi.

"The river column, consisting of the two steel boats and several canoes in charge of Lopes, my Portuguese collector, and manned by native porters, left Ibi for Ashaka on the upper Gongola on June 30. This journey was eventually accomplished, but not without considerable difficulties. Heavy rain-storms often delayed progress. Near the mouth of the Gongola, the Bassama tribe, who inhabit the left bank of the Benue, attempted a night raid on the boats, but this was discovered in time by the sentry. On the lower reaches of the Gongola, the natives, owing to severe famine and recent military operations, were in a state of starvation, and consequently no food could be obtained for the column. On July 30, Kombe, about 60 miles from the mouth, was reached, when the real trouble of navigation commenced. At this point the river narrows considerably to a width of about 150 yards. The bed becomes rocky and the current strong, being reckoned at 9 miles per hour. It was here that the first rapid was encountered, which involved the boats being towed from the bank for a distance of 2 miles. Beyond Kombe more rapids were met with, and the boats again had to be towed for a distance of 6 miles, while the long cane and overhanging trees increased the difficulty of this operation. On August 11 the vicinity of the Bima hills was reached, and the boats again had to be towed for another 4 miles. Four days later the boats arrived safely at Ashaka, and were successfully taken to pieces by my collector. The Gongola is subject, like all the smaller rivers out here, to a very sudden rise and fall. Our boats got up just at the right time—in July—in order to catch the flood. In August the river falls rapidly; by the end of September it again becomes fordable.

"On August 24 Gosling arrived, after a successful journey through the Gongola district. On August 30 a forward movement was made on to Gujiba—a good three days' march over a bad road, in many places nothing more than a quagmire. Each section of the boats was carried by four men, by means of two bamboo poles put through rings on each gunwale. By September 7 both boats and a considerable number of stores had been safely transported to Gujiba. Two days later, Gosling with the two boats left for Geidam, followed by the collector with the rest of the expedition goods. Geidam is a good five days (120 miles) to the north-east of Gujiba, and is situated about a mile from the river Komadugu. It is an important caravan centre, the goods from Kano coming this way to Kuka. On the banks of the river the boats were put together again, and the journey down to Yo was commenced on September 24. Gosling accompanied the boats, while the collector left by road, which frequently touches the river, and this enabled junctions at various places to be effected between the river and land columns. Important zoological collections were made

along the route by my collector. Nothing occurred to impede the progress of the boats, and Yo was safely reached on October 3. Yo is close to the river, and is nine hours by our boats to Bosso, at the entrance of the lake.

"The journey down the Komadugu was in every way satisfactory. Owing to the slow current (never more than 2½ miles) and its sandy bed, no snags, etc., blocked the stream. This river is very tortuous, having an average width of 40 yards, and with its low open banks in places clothed by thorny acacia good landings can be effected. From August to the middle of December the river has plenty of water, 6 to 7 feet being the average depth; but after that time a rapid fall takes place, and the river then becomes in places nothing more than a sandy bed. I think this is all I have to tell you about the river column at present. The boats have already been on Lake Chad; two have proved themselves to be satisfactory in every way.

"My brother tells me that he wrote to you from Bauchi about the survey work which was commenced at Ibi, so I will give you a rough outline of what he and Mr. Talbot have done since. From Bauchi the course taken was by Gombi and Daraso right up into the Kerre-kerre country, and from thence down the Gongola to Ashaka, where they arrived on August 17. The original scheme of triangulation in the Tonga district had to be abandoned, owing to the severe famine in the country—in fact, all along this has been one of the greatest difficulties the survey party has had to contend with. On several occasions my brother had to go long distances out of his course in order to get supplies for his men. On August 19 Talbot left for Bima, and from there penetrated into the Marghi country, but not without difficulty and opposition from the natives. In the mean time my brother traversed the Gujiba Maigumeri road, and eventually effected a junction with Talbot about three days to the south-east of Maiduguri. Up to then much useful work had been accomplished, but it had entailed arduous work. In the Marghi country the hills ceased, and heavy bush clearing had to be carried out, over a hundred men being employed for the purpose.

"I am leaving Yo to-morrow on my way to Kuka to meet my brother and Talbot, and also to select a base for the boats on Lake Chad between this place and Kuka. It is not safe to keep the boats much longer at Yo, owing to the falling of the river."

JOMOKANGKAR.

By Major C. F. CLOSE, C.M.G., R.E.

THE maps of the Tibet mission are now being drawn in the Survey of India offices at Dehra Dun. A very interesting result of the process of drawing the new maps and examining the old has been the identification of a peak to which the name Jomokangkar undoubtedly belongs.

The officers of the Survey of India who have lately been at work in Tibet report that the old explorer A-K (Krishna) was very accurate and reliable. His work, which was carried out under considerable difficulties, has well stood the test of the recent survey operations. A-K was a survey explorer from 1869 to 1884; he has always deservedly been held in esteem by the geographical world.

Now, in a map published by the Survey of India in 1872, to illustrate A-K's explorations, there will be found a mountain marked "Jhomogangar Snowy Peak," of which the position is lat. 29° 50′ N., long. 89° 50′ E. (about 215 miles north-east of Everest). This fact appears to have escaped the notice of those who have recently discussed this question of nomenclature. The name Jhomogangar has been printed on all subsequent maps of this region. For instance, on the North-Eastern Frontier Sheet, No. 6, scale 8 miles to 1 inch, will be seen the words, "Jhomogangar Snow Peak: very high."

Let us now turn to the General Report of the G.T. Survey of India for 1873–74 by General Walker. Attached to this is an appendix entitled "Account of Trans-Himalaya Explorations during 1873–74." Pages iii. to viii., written by Major Montgomerie, himself a very well-known frontier explorer, describe A-K's exploration. On page iv. of this narrative occurs the following passage:—

"On January 6 they reached Dung Chaka, 15,700 feet above sea-level. About 10 miles to the east there is a lofty snowy peak called Jhomogangar, somewhat of the same shape as the Kailás peak near Mánsarowar; it is a noted object of worship, being considered as a female divinity."

As geographical evidence, the above may be preferred to anything produced by Sarat Chandra Das, on whose authority the identification of Everest with Jomokangkar mainly rests. Colonel Waddell, who supported this identification in his book, 'In the Himalayas,' produced no fresh evidence. It is to be noted that Sarat Chandra Das, though a traveller, was no surveyor.

As regards the accomplished surveyor, A-K, he was half Tibetan by birth, a native of Milam, on the Tibet border of Kumaon, and spoke Tibetan perfectly.

It appears, therefore, that either there are two great peaks to which the natives have given the same name, or Sarat Chandra Das was mistaken; and the relative probability of these alternatives can be decided in the light of the facts mentioned above.

This note is written, not for the purpose of stirring afresh a controversy which was summed up to the satisfaction of most geographers by Mr. Douglas Freshfield in his letter to *Nature* of November 24 last, but solely for the purpose of drawing attention to facts which had slipped out of remembrance, and which have been again brought to light by the officers of the Survey of India.

THE SUBMARINE GREAT CAÑON OF THE HUDSON RIVER.

By J. W. SPENCER, A.M., Ph.D., F.G.S.

PREFACE.

THE submarine cañon off Cape Verde, worked out in a splendid manner by Mr. Henry Benest, has already appeared in this *Journal*. That of the Congo was described earlier in Scotland by Mr. J. Y. Buchanan. The "Bottomless Pit" and Fos de Cap Breton were also shown as to their parts. Scattered discoveries of drowned valleys are many. Great systems have been worked out by Prof. Edward Hull, Dr. Fridtjof Nansen, and the writer; but the details of the cañons are not so well known for want of fuller soundings. Now, the magnificent cañon of the Hudson river is revealed to great depths, with the advantage that it is situated at the door of the American continent in place of in an obscure corner; in a region of known geology where its age can be determined; and in a locality particularly devoid of late tectonic disturbances, so that it throws much new light on the question of submarine valleys, and involves principles as important to Europe as to America, which justifies the original description appearing simultaneously in Britain as in America (*American Journal of Science*). An abstract of this paper in advance was read before the International Geographical Congress (Washington, D.C., September, 1904).

AN ACCOUNT OF WHAT HAS BEEN DONE BEFORE THIS DATE.

The early work of the Coast Survey brought to light a depression extending from near New York to the border of the continental shelf. Prof. J. D. Dana was the first to recognize this feature as the submerged channel of the Hudson river, formed when the continent stood at a greater altitude above the sea than it does now. So much importance did he attach to it, as evidence of terrestrial oscillations, that a map of it appeared in all the editions of his 'Manual of Geology,' since 1863, but only in the latest edition (1895) was it shown to reach to a greater depth than 720 feet. In the last revision the upper channel and the cañon sections are distinguished, the latter to a depth of over 2000 feet. But the discovery of the cañon was first announced by Prof. A. Lindenkohl in 1885,* and further discussed in 1891.† He found that it reached to a depth of 2844 feet, where the adjacent continental shelf was submerged to only 420 feet—a gorge of 2400 feet in depth. From the soundings beyond the deep point, he at first thought a bar of 1600 feet in height crossed the mouth of the cañon.

In 1889 I pointed out that this cañon, along with those at the mouth of the Gulf of St. Lawrence and of the Maine, could be taken as yardsticks in measuring the late continental elevation to the extent of 3000 to 3600 feet. This was in the second paper published by the Geological Society of America, the first being by Prof. Dana.‡

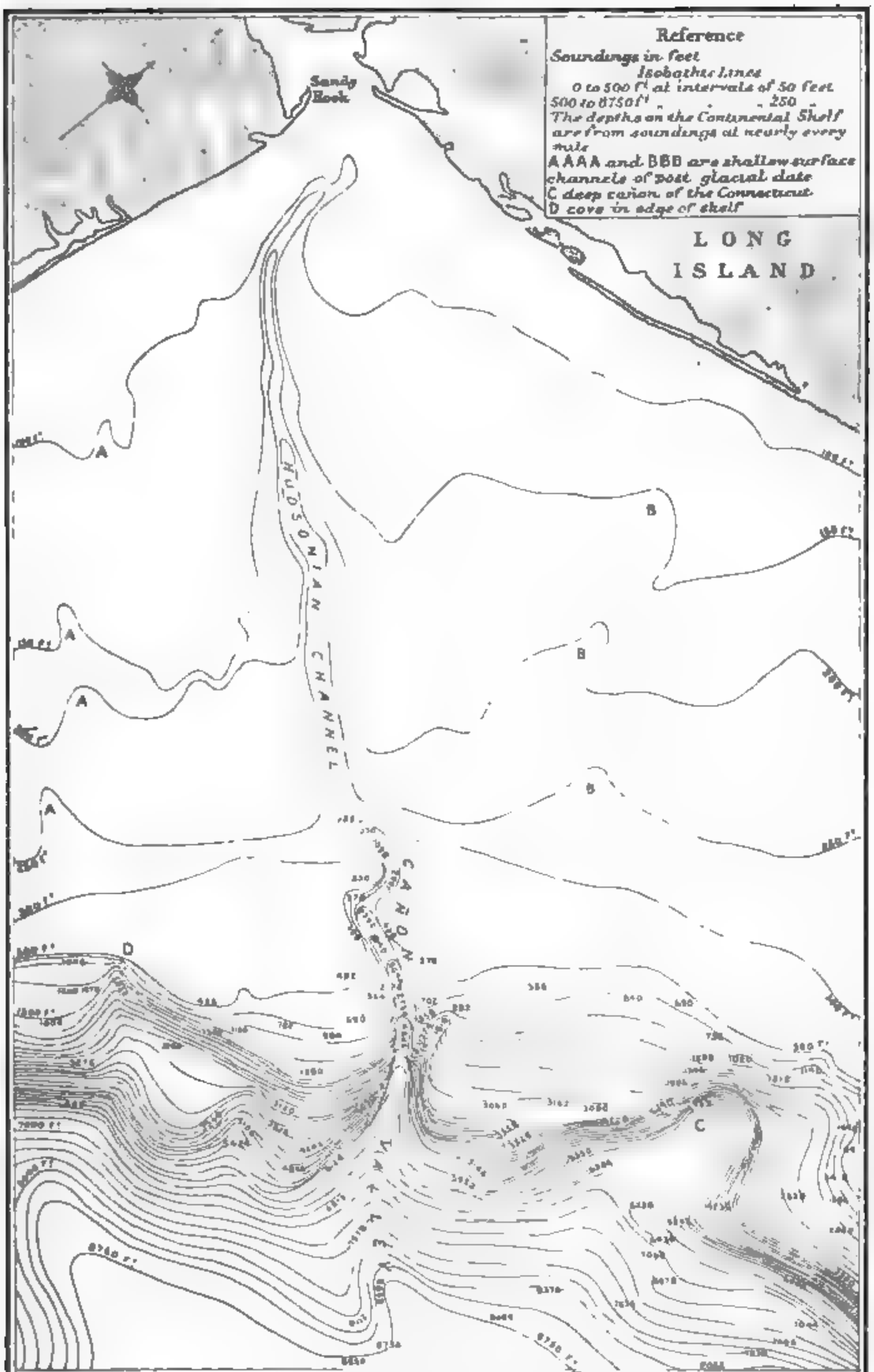
A few months later Dr. Warren Upham cited the Hudson cañon among the evidence he brought together to show that elevation was the cause of the glacial period.§ In it he attributed the apparent bar to the action of coast-wise wave-wash during the subsidence of the continent after the formation of the gorge. Though

* *Am. Jour. Sc.*, III., vol. 29, pp. 475–480 (1885).

† Ibid., vol. 41, pp. 489–499 (1891).

‡ "The High Continental Elevation preceding the Pleistocene Period," *Bull. Geol. Soc. Am.*, vol. 1, pp. 65–70 (1890).

§ *Bull. Geol. Soc. Am.*, vol. 1, p. 563; also *Geol. Mag. Lond.*, III., vol. 7, p. 494 (1890).



SUBMARINE GREAT CAÑON
of the
HUDSON RIVER
by
Prof J W Spencer A M Ph D
Scale 1 800000 or 12.62 miles - 1 inch

this bar was a large order for wave-action, it was the only reasonable explanation of the deep hole, if such it were, as suggested by the Coast Survey chart.

Again, in 1890 Prof. Dana published a paper,* in which he says that the channel "affords strong evidence of the river origin, and therefore the whole channel up to New York was once the course of the Hudson." In the last edition of his Manual he further says (p. 948) that the former emergence of the continental border now sunken is proved by the Hudson submerged valley, citing also the cases of the cañons of the gulfs of St. Lawrence and Maine, mentioned above, as evidence of the elevation of the region in the glacial period to at least 3000 feet. It may be here stated that Prof. Dana, on seeing my account of the submarine valleys of the West Indian region, wrote to Prof. Lindenkohl, who replied that he was not aware of them, and hence the note in his Manual concerning them (p. 949). Prof. Lindenkohl, however, later accepted my interpretation of the much deeper valleys † which Dana doubted, confirmed by Prof. Lindenkohl's want of knowledge at the time, though Prof. Dana accepted my St. Lawrence cañon to 3600 feet below sea-level.

In 1897 I read a paper before the British Association, stating that with the very insufficient soundings, the Hudsonian valley was recognizable to a depth of 12,000 feet,‡ illustrating how we may anticipate where cañons may be found. This paper,§ amplified into "The Submarine Valleys off the American Coast" in 1902, taking such phenomena as a whole, showed there was accumulative evidence suggesting that these submarine features were gauges for measuring the late great continental elevation.

The most recent discussion, including that of the Hudsonian channel (1904), is in Dr. F. Nansen's epoch-making monograph on "Continental Shelves and Previous Oscillations of Shore Lines," ‖ reserved for later consideration.

The Hudsonian Cañon.

The channel described by Lindenkohl begins about 10 miles off Sandy Hook, and extends for 93 miles before it plunges into the cañon. Land miles, and not sea miles, will be used throughout this paper. At its head, opposite Sandy Hook, the channel is buried by the sand of the coast-wise drift-forming bars, though nearer New York it is much deeper. Lindenkohl had described the depth of the cañon to 2844 feet below sea-level, with a bar in front, and no further information is shown on the U.S. Coast Survey charts. In revising my last-mentioned paper, I found much additional data on the charts issued by the Hydrographic Office, greatly strengthening the evidence of the continuation of the Hudsonian valley, extending down the continental slope to great depths. But on the British charts I made a most astounding find of three soundings of 459, 801, and 229 fathoms. The position of the 459 and of the 801 soundings of the British chart so closely coincided with those of the Coast Survey chart ¶ at 213 and 345 fathom points that they could not have been represented on the same charts. Thus the British chart showed no barrier to the cañon, and very greatly increased the known depth of

* "Long Island Sound in the Quaternary Era, with Observations on the Submarine Hudson River Channel," *Am. Jour. Sc.*, III., vol. 40, p. 425 (1890).

† *Bull. Geol. Soc. Am.*, vol. 14, p. 226 (1903).

‡ Ibid., pp. 207–226.

§ Ibid.

‖ "The Bathymetrical Features of the North Polar Seas, with a Discussion of the Continental Shelves and Previous Oscillations of Shore Lines," by Fridtjof Nansen, Quarto, pp. 1–232, plates 28. Published in English by the Fridtjof Nansen Fund for the Advancement of Science, Christiania, 1904.

¶ Coast Survey Chart, No. 8. B.A. Chart, No. 2480.

the narrow gorge, further defined by the 229-fathom point. The extraordinary depth would have been startling had it not been anticipated in all of my long series of analyses of submarine valleys. Both series of soundings were correct, the deeper ones having been made by Lieut.-Com. Z. L. Tanner * in 1883, in the Fish Commission steamer *Albatross*. The older soundings had been retained on the Coast Survey charts.

The cañon of the Hudson river may now be extended and revised as follows: The mean edge of the continental border may be taken at a depth of 450 to 500 feet below sea-level. The head of the cañon, in a direct line backward of the edge of the shelf, is 20 miles, but its course is somewhat longer. The upper channel has a depth of 42 feet in the very level sandy plain, which is then submerged to only 288 feet (though 100 miles from New York harbour). At this point there is an abrupt descent from the bed of the upper part to 1098 feet in the cañon, within the distance of about a mile. The gorge soon deepens to 1242 feet, where cross-section A is taken.

The cañon extends nearly due east for 6 miles, where its depth reaches to 1662 feet. It then bends sharply at right angles to the south, and at 12 miles from its head a narrow inner gorge descends from 1770 to 2292 feet (in a distance of 1·5 mile), where the broad outer cañon attains a depth of only 1500 feet below sea-level. Here the shelf is submerged about 250 feet; accordingly the outer and inner cañons have respective depths of 1250 and 2050 feet. A cross-section is shown in Fig. E (added since paper went to press), which is located near the soundings of 2292 feet shown on the map and longitudinal section. Here the cañon turns again at nearly right angles towards the east, though farther on it bends slightly south-eastward. A depth of 2640 feet is reached in 18 miles where cross-section B is taken. At 23 miles the depth is 2844 feet, and at 26·5 miles is the position of the 213-fathom sounding, which was supposed to have indicated a bar, and close against which is the discovered sounding of 459 fathoms, as shown in the precipitous wall in cross-section C. Nearly midway between these soundings is one of 457 fathoms (the last two not being situated quite in the centre of the channel). These, with others on record, but not shown on the published charts, form a chain of soundings from 1 to 2 miles apart, reaching to near the floor of the inner gorge, thus establishing its continuity. At this locality, also, unpublished soundings further show the double cañon, the outer of which, with a breadth of 4 miles, is revealed to a depth of 1200–1300 feet below sea-level, while the inner has a width not exceeding a mile, but reaches to over 2800 feet. The gradients and depths of the cañon and their relation to sea-level are shown in the longitudinal section, Fig. 1. At 31 miles the 801 fathoms is found, close against that of 345 fathoms, not shown on map. This last is on the side of the gorge of 3800 feet, where the continental slope is further submerged 1000 feet. Here, too, is a great downward pitch in the gradient of 2000 feet in 4 miles. At this point the maximum breadth of the gorge, nearly 3800 feet above the floor of the cañon, does not exceed 2 miles, with the bottom necessarily narrower. Seemingly, part of the slope of the wall where the deep sounding was found approaches 60 degrees. At 34 miles there is a short tributary from the north, heading in a typical cove. Beyond this point, where the sounding is more than 4806 feet deep, the cañon feature must continue for several miles at least. I have carried it to the 42-mile point, where the continental shelf is submerged to 3000–3500 feet. At this depth we have several soundings, which show that the 3000-foot isobath continues in a direct

* Hydrographic Notice to Mariners, No. 56 (1883).

line, as if across the cañon, without any known suggestion that it sweeps round into the form of a broadened embayment. Its parallelism to the 500-foot line of the edge of the shelf shows the remarkable regularity of this zone of the great slope. There is also suggested the remains of a shelf or bench of depth corresponding to the Blake plateau south of Cape Hatteras.

Within a few miles the cañon appears to broaden out, and yet at 48 miles there is a steep cliff of 2000 feet or more on its southern side. Here the floor exceeds a submergence of 6126 feet, as the measurement is not in the centre of the valley; nor have we obtained the sounding on the opposite northern edge, the last in the gorge being 4800, confined within walls of 3800 feet, though the walls are known on both sides lower down. Indeed, this depth is still below that of the continental slope at 48 miles. Evidently the cañon section must reach to a depth of from 6000 to 7000 feet, which also corresponds to the deep valley of the Connecticut (C on map).

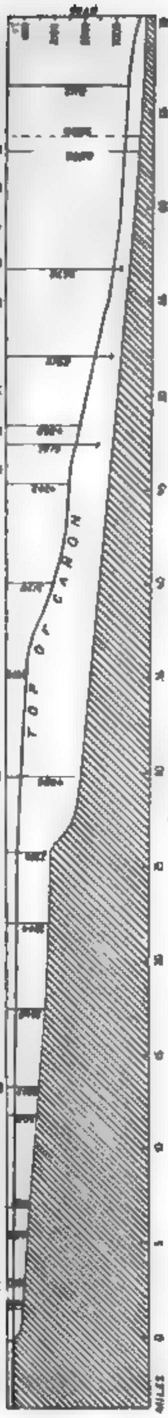
Beyond the cañon section is the southern side of the extended valley, demonstrated by a line of soundings, though not at its summit. The four soundings at about 8688 feet are specially important as proving the continuation of the Hudsonian valley. The first of these is at 63 miles. At 67 miles the lateral bank is at least 624 feet high (probably 1000 feet at least above the floor), and our record carries the valley to 71 miles from the head of the gorge. The end of this lower reach does not exceed 14 miles in width, but fuller soundings may limit it to 8 or 10 miles. Thus the valley is shown to exist to a depth of 9000 feet.

Beyond this point there are no soundings in the line of the valley, but lateral ones on both sides are suggestive, and at 100 miles east of this study, at a little less than 12,000 feet, is an embayment of 30 miles in breadth, with the depth of a few hundred feet. This cannot be a meaningless feature, though not part of the present analysis.

The breadth of the cañon hardly exceeds a mile at its head, but it soon widens to 2 miles or more. From the second turn (see map) a breadth of 4 miles is maintained for the outer cañon. The deeper inner gorge is reduced to a width of a mile or less, and is more sinuous than the outer. Beyond the tributary it is wider, 5 or 6 miles, though possibly more, as the next sounding is farther away; but a little greater or less detail does not alter the general features, and the only important points left relate to the question of the cañon opening out into the valley and its depths, which the analysis shows is 6000 to 7000 feet, and farther on the characteristics are those of a valley rather than a cañon to 9000 feet below sea-level.

Surface Channels of the Continental Shelf and the Deep One of the Connecticut.

The surface of the continental shelf is a marvellously flat plain, with a mean slope not exceeding 3 feet per mile. This condition represents a flat substratum, even though there may be hollows in it levelled over by sand deposits. Nearer than Long island there is no trace of a moraine, either buried or submerged. The surface of the plain is covered over with sea-washed sand, except in the Hudsonian channel. This adjective termination I have long used to designate the drowned sections of the river valleys. The sandy plain is traversed by shallow channels shown on each side of the map at AAAA and BBB. These would be still better followed if more isobathic lines were introduced. It is to a depth of 250 feet that these channels are most noticeable. They represent the stream-action of an epoch of elevation to this amount since the time of cañon-making, and subsequent to the levelling over of the plain after that date. That is to say, these channels absolutely



Vertical Scale exaggerated 4 times

FIG 1.—LONGITUDINAL SECTION OF SUBMARINE GREAT CAÑON OF THE HUDSON RIVER.

At points where depths end in arrows the soundings were not taken in centre, but on side of the valley. A, E, B, C, D, location of cross-sections. E is situated 4 miles above B. Soundings given in feet. Since going to press, from additional information, abrupt steps of 400 and 500 feet respectively are found to occur in the gradient just above depths of 1662 and 2292-foot soundings.

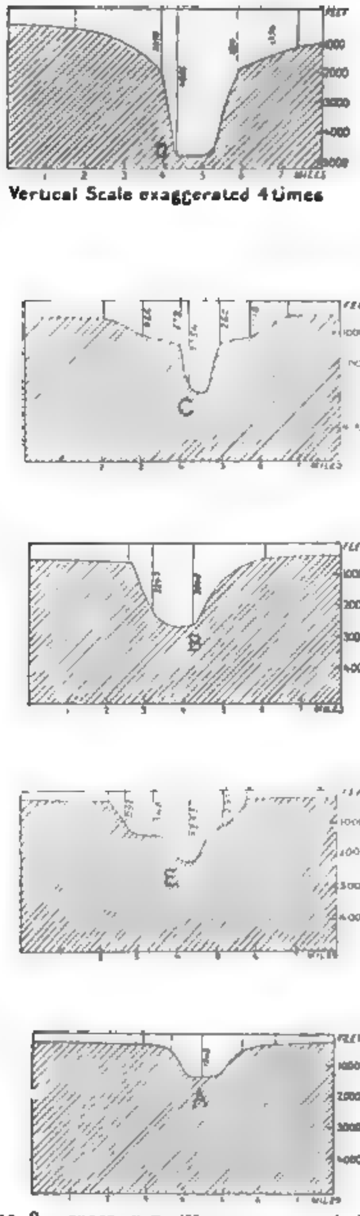


FIG. 2.—CROSS-SECTIONS LOCATED AT A, E, B, C, D, IN LONGITUDINAL SECTIONS.

Their position on map corresponds to similar depths, in feet, there shown. E (at a point 4 miles above B) and C show the double character of the cañon.

belong to a post-Columbia or Pleistocene epoch, the cañons to a pre-Columbia or early glacial time. During the Columbia oscillations wave-action has obliterated all traces of delta forms.

The channel of the Hudson river, in crossing the submarine plain, shows a bottom of blue clay with sandy material in places; but the course of the old upper channel must have been still defined to have allowed its reopening during the epoch of re-elevation of 250 feet just mentioned.

In the cañon section, the bottom is composed of blue clay with fine sand. Outside it the continental slope is also surfaced with blue clay or green clay, as shown by many soundings.

The great Connecticut cañon or valley, asked for by Lindenkohl,* is represented (at C on the map) by a deep embayment, whose west wall is at least 3600 feet high, and it reaches to a depth of 5736 feet below the surface of the sea, but the information is not at hand to define its form, though a cañon, perhaps passing into a valley at this point, might be expected.

At D, on the other side of the map, one sees a cove or amphitheatre such as are commonly indenting the borders of high plateaus. I may have too strongly represented the feature on the map, but it is not one of special importance.

Constitution of the Continental Shelf.

All our classic teaching tells us that, during the earlier and middle Mesozoic era and far into the Cretaceous period, the continent here was so elevated and subjected to denudation that the sediments were carried far seaward. We cannot go into the question as to their covering the continental slope, but it would seem that the continental shelf now submerged was subjected to the same conditions as those underlying the coastal plains of the adjacent lands. On these we learn that, besides a few hundred feet of Potomac sands which probably thin out, there are deposits of sand, greensand, clay, and clay marl of the Upper Cretaceous formations, reaching a thickness of 800 to 1100 feet. Then follow some Eocene sands, succeeded by clayey, marly, and sandy beds belonging to the Miocene beds. These occur in an artesian well boring at Atlantic City, reaching to a depth of 1400 feet (without penetrating the series or the limited Eocene sands or obtaining water at the lower depths, though somewhat higher fresh water occurs, indicating the leaching out of the salt sea-water during an epoch of elevation). All below 265 feet is Miocene. This upper part is composed of sand, gravel, and clay, which may represent important features requiring a word of explanation. Of red gravel, sand, and stiff clay loam are composed both the Lafayette and Columbia formations, each of which is a thin sheet, except where filling valleys. The Lafayette is provisionally regarded as belonging to the end of the Pliocene period, occurring below morainic material, as I have seen in New Jersey; but it has been enormously denuded. The Columbia formation (now subject to subdivision) is the material of the Lafayette redeposited, and overlies the drift, with its surface only moderately sculptured. I should suspect that at Atlantic City is a buried channel filled mostly with these deposits of the Columbia period, capped with more recent alluvium. These upper beds are substantially horizontal, with the Miocene dipping a little more. For the details of the Miocene deposits in the Atlantic City well, see the paper by Mr. L. Woolman.†

Thus not knowing whether these incoherent formations have a greater or less aggregate thickness beneath the submerged coastal plains, there are only known

* *Bull. Geol. Soc. Am.*, vol. 14, p. 226 (1903).

† *Acad. Nat. Sc., Phil.* (1887), p. 339; and vol. for 1890, pp. 132–147.

little over 2200 feet to be accounted for from the adjacent shores. But they have formed the sub-surface of the level plains now submerged, and channelled by the drowned Hudson river, and finally incised by the cañon on the continental border. Here, then, in its upper portion the gorge penetrates easily denuded material, though some of the beds are composed of remarkably tough clay. Where the sides of the cañon are so precipitous as was shown at the 459 and 801-fathom isobaths, we may suppose that the lower portions are cut out of the harder older rocks, succeeded by more yielding material farther down the submarine valley.

Origin of the Cañon.

It appears that the previous students of the submarine channel have all had the idea that it was formerly a land valley. Such analysis of the phenomena as has been given must be used in discussing its origin under any other hypothesis. While a few other soundings are desirable for fuller local details, we need not one more for a reasonably full discussion of the principles involved—only enough are wanting to stimulate interest in a revision. Not to speak of similar phenomena farther south and in the West Indies discovered by myself,* and those since brought to light and systematized in a brilliant manner by Prof. Edward Hull, of London, situated on the eastern side of the Atlantic basin,† I shall mention the cañon of the Congo, discovered by Stassano, and worked out by Mr. J. Y. Buchanan and described by Mr. Edward Stallibrass, and the cañon off Cape Verde, described by Mr. Henry Benest, on account of the completeness of detail of such features, not hitherto obtained, but with which the Hudsonian cañon can now be grouped with the advantage of our knowledge of the surrounding physiographical and geological environments, and with the further interest in that it is situated at the main door of the continent.

If formed by river action, the Hudsonian cañon affords proof of startling physical conditions of the region at a very late date, and hence the whole interest in its origin; for if now a land feature, it would be one of not such unusual occurrence as to awaken our amazement. Can the views of the earlier writers be challenged? The only other possible causes of its origin seem to be—(1) Submarine glacial erosion; (2) open faults; (3) submarine rivers; and (4) a remnant of a primitive depression. This last would only be suggested by an obstinate objector to its fluviatile origin, or one unfamiliar with the analyses of such subjects; for after passing the Palæozoic evolution of the continent, what is now its great slope should be covered with detritus carried into the sea during the long period of denudation of the Mesozoic era, thus obscuring older depressions. Some of the African cañons have been attributed to submarine rivers. By this the hypothesis of a great elevation of the continent was avoided. There seems nothing in its favour beyond the occurrence of river valleys at great depth and some floating *débris* on the sea. As Prof. N. S. Shaler says, subterranean channels must be formed above the base-level of erosion, and the establishment of such must precede that of submarine rivers, which soon lose their effectiveness.

Can the question of cañons be cavalierly disposed of by calling them faults? The level continental shelf is covered with Tertiary sands and clays, such as would not favour an open-fault theory. The submarine topography on both sides is identical, suggesting not the slightest disturbance to leave an open fault, nor is such shown on the land adjacent. Joints and faults may locate valleys, but the

* "Reconstruction of the Antillean Continent," and other papers in *Bull. Geol. Soc. Am.*, and in *Quar. Journ. Geol. Soc. London.*

† Published by the Victoria Institute, London.

submarine shelf is only a new plain prolonging the Hudson valley, which in slowly rising would force the water to follow the lowest course. The fault theory is not supported by the Great Valley of the Appalachians, extending for 1000 miles, with a breadth of from 20 to 40 miles. And it is in a region abounding in fault; yet the valleys, as have long since been shown by Profs. Lesley and Dana, and others, are those of denudation, and which I have confirmed in Georgia. Even the gorge of the Delaware Water Gap, where more than a tyro might be pardoned for suspecting a fault left open, is not such according to Prof. Lesley and Mr. Chance, the geological surveyor of it. The submarine cañon of the Hudson, which is double, the inner the more sinuous, does not lie in a direct line, but turns twice at right angles within a distance of a dozen miles, and below it widens into a fan-shaped valley. Nansen has described many submarine valleys in the continental shelf of Norway and about Iceland, and does not find it necessary to call in the existence of faults; and even where my evidence has not been full in treating deep submarine valleys, he thinks there is no other feasible explanation than that the valleys are sunken land features (p. 192). Nor will those who appeal to Sir A. Geikie find much comfort in faults. He says, "To many geologists the mere existence of a valley is evidence of the presence of a fault," and that "in every case actual proof of a fault should be sought for in the tectonic structure of the ground. . . . In the vast majority of cases in Britain valleys have no connections with faults." From its forms and its associations, I think we can dispense with the idea of a fault-made rift, unaffected by atmospheric action. And, furthermore, this is not in the region of apparent great tectonic disturbances, but one of remarkable simplicity, since in Cretaceous times.

Finally, I know of no other reason for appealing to faults as the cause of such a submarine feature, except as a last resort from accepting the evidence as is set forth in this paper, unless such a reason can be shown to exist, other than by negative or insufficient evidence.

As for submarine glacial erosion, I have shown that there are no features of the shelf suggestive of the occurrence of glacial action, even though such reached to Long Island and New Jersey. Furthermore, it could not have possibly extended to the great depths of the cañon and the continuing valley. Of this question Dr. Nansen says in his great monograph, "The drowned valley of the Hudson river cannot possibly have been reopened by submarine glacial erosion; it is too long and narrow and deep" (*Op. cit.*, p. 192). Its analogues of the tropics are situated beyond glacial action.

Of the drowned valley of the Gulf of St. Lawrence, Prof. N. S. Shaler also writes, but I do not remember whether he considers the then discovered Hudson river cañon.

Returning now to long-accepted fluviatile origin of the submarine channel, let me call attention to the very close resemblance of the cañon, as shown on the map, to the gorge of the Niagara, also excavated out of level plains, far from mountains, in front of which are great slopes to lower levels. But this portion of the Hudsonian cañon is 30 miles long and reaches to thousands of feet in depth, while that of the Niagara is only 7 miles in length and now 440 feet deep. So, too, the cañon of the Hudson is just like the *barrancas* on the high plateaus of Mexico and Central America, starting in level plains, and then suddenly transforming themselves into rapidly descending cañons, which later widen out into such valleys (as we may see in the east, which have reached more mature forms), whose descent from the plateaus of thousands of feet in height is not by regular gradients, but commonly by a succession of great steps.

The Magnitude and the Time of the Great Elevation.

While it must have taken the Hudsonian cañon many millenniums to have formed, yet it presents a youthful feature, in strong contrast with the valleys on the eastern side of the American continent, while its submerged marginal shelf is not deeply indented, with its surface scored into a succession of ridges and hollows. Even though many of the underlying rocks may be of a resisting nature, yet the period of cañon-making must have been one of limited duration. This is further suggested when considering the size of the Hudson river, which probably carried down glacial waters and detritus for a portion of the period. Outside the limit of the Hudsonian river, the surface of the now submarine plain was not deeply scored as with atmospheric agents acting for long ages, as would have appeared beneath the superficial mantle had such obtained. One condition might modify this last argument, namely, a subsequent long epoch of wave-cutting, with the removal of the prominences, such as Nansen describes in his "coast platform," which does not exist here, but in such a case the Hudsonian gorge should have been filled with *débris*.

In the region of the Great Lakes, from the tilting of beaches, I have worked out great epirogenic movements, and it quite prepares me to expect to find a reduction of the amount of elevation of the continent, represented by the present submergence of the valleys along our continental margin due to bending downward of the continental slope, but this would not reduce by any amount that determined in the cañons and the necessary slope of the land surfaces. So, also, when we find subaërial features submerged, they at least would need to have been depressed to the depth they are now found at, no matter what the cause of depression.

The cañon section has sunken 6000 to 7000 feet, and the valley beyond to 9000 feet. Did I attempt to guess at the reduction of this amount in the late height of the continent, I should be inclined to pause, owing to other features outside the line of this study. But if others wish to reduce the continental elevation by 2000 feet, by extra bending down of the continental slope, I shall not protest further than by stating that additional evidence beyond our limit may replace it. Provisionally, then, we may keep the amount of elevation at 9000 feet, as shown here, leaving others to correct the figures if found to be excessive. On the other hand, I have no idea that the present heights of the mountains were relatively nearly so great as now.

Fragments of the Lafayette formation should extend from New Jersey, and underlie the surface of the continental shelf. The great denudation of the region was after the Lafayette period, as was proved by Prof. W J McGee. I have found these beds underlying glacial deposits in New Jersey. They are provisionally regarded as Pliocene, unless they are pre-glacial Pleistocene, as thought by Upham. On the surface of the overlying till rests the Pleistocene Columbia red loams, sands, and gravels, in samples not distinguishable from those of the Lafayette formation, except in the smaller size of the gravel. And it is such materials which are obtained in the Atlantic City well (Woolman). The denudation of the Lafayette has been so extensive, that its remains would be more likely outside of a channel, buried as this appears by the Columbia formation, which has levelled over and furnished materials for the surface of the continental shelf before the re-excavation of the small channels at AAAA and BBB on the map (p. 18). These channels, as mentioned before, represent a re-elevation of the drowned plain to as much as 250 feet in the later Pleistocene period, since which time the region has been again once or twice depressed, then re-elevated slightly and channelled, and is now sinking at the rate of 2 feet a century (Prof. Mitchel). All the changes are remarkable repetitions of those which I have shown to have occurred farther south and in the West Indies. Thus it may be seen that the cañon-making period was in the earlier Pleistocene, and accords with Prof. Dana's views as expressed

in the last edition of his Manual, and those of Dr. Upham, only the evidence is in more detail, showing a much greater elevation than was then known.

I have not touched upon an earlier Tertiary valley, as such could apply only to great depths beyond the cañon section.

Summary and Conclusion.

More than forty years ago, Prof. J. D. Dana first recognized the submarine extension of the Hudson river in the soundings on the continental shelf. In 1885, Prof. A. Lindenkohl discovered the channel suddenly transformed into a cañon near the continental border, reaching to a depth of 2400 feet below the surface of the submerged plain, which is here about 400 feet beneath sea-level; but near the then known mouth there appeared a great bar. In 1897 I pointed out that the channel was traceable to great depths, which is now proved. A sounding was made near the supposed bar, which has proved to be only a measurement taken on the side of a deep cañon, with a precipitous wall. Then 4 miles beyond this point, against another lateral bank, a further sounding reaches to 4800 feet, revealing a cañon 3800 feet in depth, where the continental shelf is not submerged more than 1000 feet. High up on the sides, the gorge here is less than 2 miles wide, but the incision of the outer cañon into the shelf has a breadth of 4 miles. At its head the cañon begins in an amphitheatre, having a descent from 330 feet to 1100 feet in the distance of about a mile. Two more steps, of 400 and 500 feet respectively, follow. Again, between 27 and 31 miles below its head there is another great step of 2000 feet to the depth of 4800 feet mentioned, and the gradient below is probably by other great steps. This is just beyond the border of the submarine plain, and shows the cañon with a depth of 3800 feet. The cañon is double; a second or more sinuous inner gorge traverses the outer. A little farther on is a tributary heading in a cove. At 42 miles the cañon begins to widen into a valley, which at 48 miles has a precipitous wall of 2000 feet in height. The valley opens into an embayment or wider valley, which also receives that from the Connecticut, now discovered to a depth of about 6000 feet for the first time, but without details to describe its form. In cutting through the continental bench, at 3000 to 3500 feet beneath sea-level, the floor of the cañon is between 6000 and 7000 feet below the surface of the ocean. The valley is continuous to a point 71 miles from the head of the gorge, and where it is recognizable at a depth of about 9000 feet.

The cañon and valley discovered to the great depth shown, incising first the level continental shelf (in which it turns twice at right angles), and then coursing down the great continental slope, is now taken as a gauge for measuring a late high continental elevation of the region to the extent of 9000 feet. This is following out the lines of Dana, Lindenkohl, and other students of the submarine channel, in that they considered it a drowned land valley. I have analyzed every other known possible cause of its origin. So great are the probabilities, and so long have these been accepted unquestioned, that very strong proof would be required to modify this view.

The period of the great elevation has been found to coincide with that of the early Pleistocene. Since then there has been a subsidence to somewhat below the present level, followed by a re-elevation of 250 feet, as seen in the shallow channels of the shelf. With other minor changes, the region is now sinking at the rate of 2 feet a century.

This cañon feature at our door corroborates the great changes of level worked out most extensively by Hull of Britain, Nansen of Norway, and myself here and in the West Indies, following methods which the father of geography, Prof. J. P. Lesley, predicted, in 1888, "must throw light on the whole subject of elevation and subsidence, as applicable to the entire area of the United States."

ON THE METHOD OF STUDYING THALASSOLOGY.*

By Prof. LUDOVICO MARINI.

THE scientific study of the sea, initiated by the genius of the Bolognese, Count Luigi Ferdinando Marsigli,† at the end of the seventeenth century, was not developed till the second half of the nineteenth century, after the American Maury had shown what important applications it was capable of. And this late development is readily explained, especially when we consider the great resources required by this study, owing to the vastness of the field to be explored, and the difficulty of reaching the greater part of it with available instruments of observation, and also have regard to the complex character of the science itself. And, in truth, the objects of thalassology are the phenomena which take place in the sea, and may be either of a physical or a chemical nature, so that recourse must be had to both of these sciences. And, moreover, for a complete knowledge of the conditions under which these phenomena occur, it is necessary to understand the nature, form, and constitution of the bodies by which the marine waters are limited—that is to say, the atmosphere above, the solid crust of our planet laterally and below; and, lastly, since it is important to be able to localize the facts according to their quality and intensity, meteorology, geology, and geography have also their share in these studies. Yet, despite its late origin, this science has already, in little over half a century of life, acquired such importance that even our Governments are making great outlays in organizing expeditions, in maintaining fixed establishments, and subventionizing associations engaged in furthering and encouraging such researches.

An indispensable condition for acquiring a really scientific knowledge in any department is the employment of a suitable method of study. Hence, if we wish to examine the data already acquired, in order to make them the starting-point for further research, it is above all necessary to inquire whether the method hitherto employed and to be employed in future is adequate for the purpose.

In determining the nature, form, and conditions of the bodies in contact with the marine water, as well as the values of the physical and chemical elements by which it is specialized, we may have two objects in view, whence it results that thalassology may be divided into two main sections. And, in fact, all those elements have different values, both in the same locality at different times and at the same time according to the locality. Hence we may undertake to determine the variations that they undergo from time to time in a given place, and calculate the mean values as may be required, and this constitutes a first part of thalassology analogous to that which in meteorology takes the name of climatology. Then from the difference in the values of the various elements in the different places, the conditions of equilibrium not being satisfied, there results a movement, a purely physical phenomenon, which constitutes the object of study of the second part—dynamic thalassology.

It is evident that the division made by me concerns the scope which may be given to thalassological investigations, not simply the division to be adopted in

* Memoir presented to the Fifth Italian Geographical Congress, held at Naples in April, 1904.

Touching the term "thalassology" I here employ, though generally little used, see Thoulet, 'Traité d'Océanographie,' vol. 1 (Statique), Introduction.

† See Prof. Cosimo Bertacchi, "Geografi italiani all' estero," *Memorie della Soc. Geogr. it.*, 1898, vol. 8, part i. *Id.*, "L'Italia e il suo Mare," *Bol. della Soc. Geogr. it*, 1900, 4th series, vol. 3, p. 762.

the compilation of a treatise on the subject. In this case it is necessary to consider the natural conditions in which the sea-water is found in contact with the other bodies by which it is limited, and their mutual relations; also to give a detailed explanation of the physical and chemical properties that characterize it, such as its chemical constitution, specific heat, melting temperature, dilatability, compressibility, thermic and electric conductibility, transparency under thermic, luminous, chemical radiations, etc. While these form the essential base of every such study, they are yet not so well known as they should be.*

It seems to me even important to note that the expression *marine statics* employed in many recent treatises, in order to distinguish this preliminary part, is not appropriate; for, although the tendency towards equilibrium is always operating, since the causes that disturb it also continue constantly to operate, actual equilibrium is never reached. It is well to avoid such an erroneous expression, since it might lead to serious errors were problems essentially dynamic to be regarded as purely static.

The biological section, which is often added to these two parts, does not, strictly speaking, come within the scope of thalassology as here understood. To wish to introduce it would be like wishing to regard the study of the distribution of the birds and insects that fly in the air as a part of meteorology, because the habitat of the various species and the migrations made by some of them depend on the changes of climate, and may serve to indicate them. In both cases the study of the distribution of organisms constitutes an important application of the respective sciences, and thalassology even owes to biological researches the chief impulse to its study.

The difference between the two parts here distinguished by no means consists in the difference between the objects of study, because the elements in which the second is interested also form the subject of research for the first, which, however, is likewise occupied with some other matters with which dynamics are not concerned. The real difference consists mainly in the method employed in accordance with the objects aimed at, a method purely statistic in the one case, synchronous in the other. But in order that the data may be discussed, and thus lead to practical results, they must be collected in a way that may satisfy the requirements of both methods. Hence this is chiefly what should concern us, if we wish to arrive at right conclusions, that is, such as correspond to the facts.

It is certain and self-evident that the method of continuous registration carried out at most of the stations conveniently distributed over the whole space occupied by the whole oceans, satisfies all requirements. But in the present state of the science it is impossible to give it practical effect, especially at great depths and on the high seas. Hence, for researches to be made in those parts there have been organized great expeditions which, ranging over a vast oceanic region, collect thalassological data here and there, in different places, at different times (excepting the vertical series of temperature and density). From materials thus collected we may say at once and without hesitation that, speaking generally, no conclusions can be drawn. It is evident that they are in no way capable of being compared together, having nothing in common in respect of time or place. The truth of this principle was already fully recognised so far back as 1890, when, by means of the highly developed investigations in the northern seas, the variations that take place from season to season were determined

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* Sandström und Helland-Hansen, "Ueber die Berechnung von Meeresströmungen," *Report on Norwegian Fishery and Marine Investigation*, vol. 2, 1902, No. 4, p. 25.

beyond all doubt.* Hence, in the impossibility of obtaining a continuous record, taking advantage of the slowness and sufficient regularity with which the variations of the oceanic elements occur, in order to facilitate the solution of the problem, it was thought advisable to limit to three months the interval of time in which it might be permitted, at least in a general way, to compare each successive series of observations one with another. On this principle was based the plan proposed by Profs. Pettersson and Ekman at the Sixth International Geographical Congress in London in 1895, for an international study of the northern waters.† But from the results of the first years of their investigations we arrive at the conclusion that variations of great range take place in the conditions of thalassological elements, even from month to month, variations which cause equivalent modifications in the type of circulation, which hence becomes distinctly different at the same period in different years, and of such variations no chart of mean conditions can give any information. In accordance with this very fact, in the bulletins issued by the International Committee for marine exploration,‡ the isothermal lines are scarcely traced at all, and on the few given isohalines doubts are even suggested regarding their real values, these being reduced from observations taken during a period of over one month. Hence it results that, for the purpose of perfect comparison of observations, at least in the upper strata, which, on the other hand, for many reasons are the most important, and particularly in places subject to great and rapid variations,§ in order to draw legitimate consequences, a more rigorous synchronism is needed. Therefore, in the present state of the science, and without excluding all efforts to achieve whatever may seem to be the best, the observations carried out in exploring ships under sail are by no means to be regretted. On the contrary, they should be multiplied to the utmost, always taking the greatest care that the records be obtained with absolutely identical methods, and so that complete confidence may be placed in their accuracy, and that they be determined on plans first thoroughly studied and laid down by means of preliminary observations. To complete the significance of these values, obtained thus independently and at intervals, the stations should be utilized where the records could be made continuous, that is to say, stations either established on *terra firma* along the seaboard, or else afloat on the light-ships, or on the model of the Scottish Ark. No valuable results can be expected until we possess a large number of values obtained in this way and then subjected to a rigorous criticism, such as that which in meteorology is applied to observations taken discontinuously. Then it will be possible, not only to know the average conditions of a region, but also to infer, which is the object of true science, what are the laws of phenomena having their bases in the sea and relations to the surrounding terrestrial surface and the atmosphere above; and to give in this way a scientific basis to the desired prognosis of the thalasso-meteorological phenomena. And meteorology, a science

* Without quoting numerous authorities, I may here refer to the monograph of H. N. Dickson, "The Circulation of the Surface Water of the North Atlantic Ocean," *Philosophical Transactions R. Soc.*, London, Series A, vol. 196 (1901), pp. 61, where is given a full bibliography of the subject.

† Pettersson, "Ueber die Beziehungen zwischen hydrographischen und meteorologischen Phänomenen," *Meteorologische Zeitschrift*, 1896.

‡ "Conseil permanent international pour l'exploration de la Mer.," *Bul. des Résultats acquis pendant les courses périodiques*, Nos. 1, 2 (1902), Nos. 3, 4 (1903).

§ M. Knudsen ("L'Océanographie des détroits danois, La Géographie," *Bul. de la Soc. de Géographie de Paris*, vol. 5 (1902), pp. 21) states that observations in the Danish waters, subject to very sudden changes, have been taken, under the direction of Admiral C. F. Wandel by several vessels simultaneously, so as to complete the necessary records in twenty-four to forty-eight hours.

so closely related to thalassology, but more advanced, should serve as its model, if it too is to progress on strictly scientific lines. At the same time, meteorology also affords proof of the importance of continuous registration for determining averages, since it shows us how a true method of obtaining the mean temperature with non-continuous observations was not obtained until a way was found for determining the true mean from continuous records.

Assuredly the most important problem in thalassology is that of oceanic circulation, about which, however, diverse views are entertained by thalassologists. We have, first of all, carefully to distinguish the object aimed at, whether it be the mere verification of the facts, that is, of the course, duration, intensity of the circulating movements in view of the manifold and important effects produced by them, or else the purpose be to determine the laws of the phenomenon. The first case comes within the scope of the first part of thalassology, and in its study we have to employ both direct and indirect methods. The direct methods involve the use either of floating bodies left free to follow the movement of the waters in which they are placed, or of current-metres. The first floats may be freely cast adrift and left to themselves, the points of departure and arrival being alone recorded, in which case, apart from the doubts respecting the accuracy of the report on the spot where they have been picked up, they leave uncertainty regarding the course traversed by them; or else they may be followed by boats fixing their successive positions, and then they are available only for shallow currents, and, moreover, require much time and many hands even for the exploration of small regions. The current-metres, although requiring a great many observations to yield conclusive results, and in the state in which they actually are, must undergo further improvement in order to be perfectly and completely adapted to the purpose, still they are based on a principle which alone can afford the most complete and trustworthy indications. In the same category may be included the study of the plankton, which, especially when combined with other methods, appears to afford most valuable data on the existence of currents.

The indirect methods consist in following the variations of temperature, or of density, or of salinity, or of the volume of gases in solution. Temperature was at one time held to be the cause of marine currents; * but to it, as a sufficient element to indicate the presence of currents, no great value is now attached, owing to its extreme variability, especially under the influence of outward agencies. The density has been used by Bouquet de la Grye † and by Thoulet ‡ for tracing profiles of the surface of the ocean, on the assumption that above a given level the depths are in inverse ratio to the densities, and so for deducing from the slopes of the surface the direction of existing currents. But, besides the fact that in the particular instances where the principle has been applied by Thoulet, the density-values utilized are not comparable one with another for the reasons above stated,§ and that from the value of the surface density alone the weight or the pressure of a whole liquid column cannot be deduced, this fundamental principle on which the method is based is valid only where there is equilibrium, hence cannot be applied to the investigation of the conditions that produce lack of equilibrium.

Salinity and the tenure of gas have been preferred by the thalassologists of

* See 'Handbuch der Oceanographie, Boguslawski u. Krümmel,' vol. 2, chap. iii., with the numerous references on the subject.

† '*Annales de Chimie et de Physique*,' No. 5, vol. 25 (1882), p. 433.

‡ *Ibid.*, No. 6, vol. 14 (1888), p. 287.

§ Recently (*Comptes Rendus*, 1[r] semestre, 1904) Thoulet describes a modification to his method, avoiding only the errors arising from non-synchronism.

the International Association for marine exploration, as being suited for recognizing a portion of a body of marine water in its course across the ocean, hence useful for indicating the trend of currents generally. But neither these, nor the density, as Thoulet thinks,* nor any other element, is capable of identifying a body of marine water, as this, not being a chemically specialized body, changes with the shifting of position in space, both by diffusion and by the tendency to recover its equilibrium, the values of all its characteristic elements. Consequently, for the purpose of verifying the existence of currents, although the above-mentioned elements could often afford valuable indications, and especially be useful for a preliminary study, still they cannot be sufficient for a complete study, so that the preference undoubtedly lies with the direct methods, and especially with the records of the current-meter.

But if the object be to determine the law of the phenomenon—that is, the relation between cause and effect, we must needs verify the effect, that is the movement, and discover and measure its causes. The inquiry concerning these causes may take a twofold course; in other words, we have to seek both the conditions of the marine elements by which the movement is produced, and the external causes that bring about the removal of the conditions of equilibrium. And these external causes may be either cosmic (solar radiation, rotation of the globe), or meteorological (atmospheric pressure, temperature of the air, humidity, winds), or geographical (presence of fresh-water streams or of particular materials constituting the terrestrial crust), or mechanical (movements of other bodies of marine waters, which by their trend, or owing to the special configuration of the basins, set up secondary currents), or biological (living organisms), which causes are all revealed by the variation of temperature, the salinity,† and local pressure. Hence, it is to the direct determinations of the values of these marine elements, and to their relations with the external conditions, that we must necessarily have recourse if we wish to successfully solve the problem. Nor are we to confine ourselves to one or other of these elements; but, as all may have their influence, they have all to be considered, since otherwise, looking at the question from a single point of view, we might come to wrong or at least partly defective conclusions.

In his exposition of the results of the Norwegian expedition in the North Atlantic, Mohn, by tracing what he calls wind-surface and density-surface, and by their means determining the current-surfaces, had already by their trend deduced the direction of the currents. Starting with the hydrodynamic equations under the simplified form given by Lord Kelvin, Bjerknes ‡ demonstrates a theorem by which may be calculated the increase of circulation of a closed curve, by means of the number of solenoids comprised within it and formed by the isobaric and isosteric surfaces. In Mohn's method the elements to be experimentally

* "Quelques Considérations sur l'étude des courants marins," *Annales de géographie*, vol. 4 (1894–95), p. 257.

† In his numerous essays, Thoulet rightly insists on the importance of not separating these two elements, temperature and salinity, but of considering them together in what he calls *density in situ*. Mohn had also introduced the idea in his dynamic studies ('The Norwegian North Atlantic Expedition,' 1876-78, No. xviii., *Circulation*); and Krümmel recognizes its importance in vol. 2 of the 'Handbuch der Oceanographie,' while Savy had already made use of it in 1868 ("Sur la Densité, la Salure et les Courants de l'Océan Atlantique," *Comptes Rendus*, vol. 67, p. 483).

‡ "Das dynamische Princip der Circulationsbewegungen in der Atmosphere," *Meteorologische Zeitschrift*, 1900, p. 97; and "Das Raumliche Gradient u. Circulation," *ibid.*, 1900, p. 481.

determined are the direction and velocity of the wind, or the distribution of atmospheric pressure for deducing these elements, and the density of marine water, from which is obtained the pressure. In the method of Bjerknes, from the density alone is calculated the specific volume, and the pressure is given from depth.* Mohn, besides leaving doubts regarding the validity of the relations between the velocity and direction of the marine currents and those of the wind, deduced empirically from an insufficient number of observations, overlooks the accelerating element, specific volume, which, as shown by Bjerknes, has much influence on the nature and velocity of the movements. To the Bjerknes method it is objected † that the effect of terrestrial rotation is neglected. But at the beginning of his essay the author expressly states that this is one of the generalizations to be introduced into Lord Kelvin's equations, but that he purposely overlooked all except the more important generalization—that is, about the limitating hypothesis respecting the density of the fluid. The deviations caused by the centrifugal force can always be brought under consideration, whenever it is desired, by means of the calculus. It is further urged that he takes no account of the direct action of the wind, which is now known to be the most important cause of marine currents. Now, the action of the wind may be shown either by the waters accumulating in the direction of its movement,‡ or by the friction causing on the surface of the sea a movement of the upper particles, which is then communicated to those below. In any case, the action of the wind is displayed in the change of pressure, caused either by changing the level, and consequently the height, of the liquid column, or by producing a movement which so acts that the pressure has to be regarded rather as dynamic than static. Hence it is absolutely necessary to be able to determine the pressure and the density with the greatest possible accuracy, especially in the upper strata, which, for the phenomena of circulation, are precisely the most important. For this purpose the pressure should be measured directly, and not merely by approximate methods, like those of Mohn or of Sandström, which are based on static considerations, and yield values that are affected by the experimental errors made in measuring the density and the depth employed in the calculus. For determining the density the best plan is to take the direct measurements on board as soon as possible by means of the hydrometers, since, besides all the objections to the preservation of the samples, the indirect methods tend to superadd the experimental errors due to two direct measurements subject, like all the others, to a source of error, namely, that of the salinity or chloridation or index of refraction, according to the method employed, and those occurring in the construction of the reduction tables (see Thoulet's numerous papers on this point). Moreover, all, or the greater part, of the sources of error which are attributed to the direct determinations are eliminated by using insulated bottles of the type devised by Pettersson and perfected by Nansen,§ slightly and easily modified so as to serve for the measurement of density by the hydrometers of total immersion, the records being made in the bottle itself at the moment the water is fished up, and without being transferred to another recipient. Collecting,

* Sandström und Helland-Hansen, "Ueber die Berechnung von Meeresströmungen," 'Report on Norwegian Fishery and Marine Investigation,' vol. 2, 1902, No. 4.

† Krümmel in a note to "Geographische Studien über das Barents Meer," by Dr. Breitfuss, *Petermanns Mitteilungen*, 1904, No. 2.

‡ A. W. Cronander, 'On the Laws of Movement of Sea-Currents and Rivers.' Norrköping: 1898.

§ Nansen, 'Some Oceanographical Results of the Expedition with the *Michael Sars*. Preliminary Report.

therefore, with such precautions, a great number of values of these fundamental elements, together with the others—temperature, salinity, gas, etc.—which can be useful for the purpose, provided they are strictly comparable, taking into account, also, the conditions of the limiting surfaces, and placing all in relation with the observed currents, it will be possible to detect the general laws of circulation.

Lastly, for marine dynamics, pursuing the study of the tides, which has been most ably treated and well advanced towards its complete scientific acquisition, precisely because for its study we possess a method of continuous observation, it is of the utmost importance to still further investigate wave motion, which lends itself to so many most interesting thalassological and meteorological problems.*

In conclusion, if we want to promote thalassology on thoroughly scientific lines, and thus raise them to the high level of the other kindred sciences, we must, above all, bring to perfection the methods of measurement of the various marine elements which accompany and correspond with the progress made in those sciences of which thalassology makes use.† Hence, in accordance with those methods, our observations have to be made synchronously and with the greatest possible continuity on the well-matured plans adapted to the special conditions of the basins to be studied and of the investigations to be carried out.

THE INDIAN CENSUS REPORT.‡

The results of the third general census of India occupy a goodly row of over sixty volumes, varying in bulk from the slim publications of Ajmer and Coorg to the veritable "John Trundley" of tomes laid on the statistical altar by Baroda and Mysore. The cream of this mass of literature and figures has been deftly skimmed off by Messrs. Risley, Gait, and Grierson into a couple of moderate-sized volumes full of an interest as varied and comprehensive as is to be found anywhere in this particular field of demography. Those, indeed, who have been steeped in the almost colourless analysis of numbers which is all that convention prescribes for a census in the prosaic West, may be a little perturbed by the oriental profusion which here greets them. It may even be that they will rise from the perusal of this report with a sense that the modicum of solid statistics provided for them has been diluted with a Falstaffian proportion of the sack of ethnological speculation. It is as well, therefore, to bear in mind the oft-repeated warning that India is a geographical expression except in regard to politics, and that the extraordinary diversity of the racial and social elements contained within it renders it impracticable to explain adequately the significance of even the numerical results of a census without recourse to more or less ethnographical detail. Between each enumeration new facts are brought to light or old ones fitted into new places, and in the lower ranks of Indian society, beliefs, customs, and even languages are fading out of existence with astonishing celerity. The Indian census reporter,

* During the revision of proofs I have seen in the *Geographical Journal*, May, 1904, the paper "On the Dimension of Deep-sea Waves, and their Relation to Meteorological and Geographical Conditions," by Vaughan Cornish.

† F. Nansen, 'The Norwegian North Polar Expedition,' 1893–96, Scientific Results, vol. 3, No. ix.; 'The Oceanography of the North Polar Basin,' preface.

‡ 'Census of India, 1901.' Vols. 1, 1a and Appendices. Part i. report; part ii. tables. By H. H. Risley and E. A. Gait. Ethnographic Appendices. By H. H. Risley. Folio. *Maps.* Calcutta: 1903. Cf. also 'General Report of the Census of India, 1901' [Parl. Paper, Cd 2047]. Eyre & Spottiswoode. 1904.

then, should be pardoned if he be occasionally tempted off the dusty high-road of figures for a canter down the shady glades of the jungle of conjecture. It is fairly open to question, however, whether in the case of the report under review, such excursions have not tended to subordinate the facts of the present day to speculative or controversial discussion of origins and evolution. The subjects of these digressions are undoubtedly of the highest interest, and their treatment at the hands of enthusiastic experts like Messrs. Risley and Grierson deserves, and will certainly receive, the most respectful consideration from the recognized authorities on ethnology. At the same time, each author is engaged on special investigations into these subjects, as respectively head of the Ethnographic and Linguistic survey of India, the final fruits of which will be issued in special publications. In these circumstances, except in so far as the correct classification of the census results is concerned, the deeper considerations of ethnology had better, perhaps, have been relegated to the place to which they technically belong, and not been interpolated, in an inchoate form, in a work the primary purport of which is statistical exposition and analysis.

Before entering upon this side of the report, a word of commendation is due to the efficiency of the scheme on which the results of the census were tabulated. By the substitution of the "slip" system of v. Mayr for the old-fashioned method of ticking each item separately on large sheets, not only was a very substantial saving effected in the cost of the operations, but the elaborate combinations of subjects, such as age with occupation and education, caste with civil condition and the like, were greatly facilitated, and the final tables containing this information were prepared with greater speed and accuracy than under the former system. It is only to be hoped that the experience thus gained will embolden the census authorities of this kingdom to modernize their methods.

The report itself opens with an admirable description of the natural divisions of India, according to the classification first suggested by Mr. Blanford and Sir John Eliot, and adopted by the latter for the meteorological work of the Government of India. The scheme is based on the normal rainfall, on a twenty-five years' average, and its seasonal variability, and it is obvious that in dealing with a tropical population like that of India, of which from 60 to 90 per cent. live by cultivation, these considerations are beyond comparison the most essential to the general welfare. The divisions do not in many cases correspond with those of race or language, but, as Mr. Risley points out, complete accord would entail an unwieldy multiplication of their number. Nor, again, is the use of these divisions extended beyond the two leading statistical factors of area and population, because the chief object of the census being administrative utility, its results have necessarily to be set forth by political areas, which have usually little relation to rainfall and little more to orographic demarcation. Taking the table as it stands, one of the features most prominent on its surface is that high density of population accompanies a high and certain rainfall, the exceptions being where the hilly nature of the country restricts the arable area, or where political troubles or widespread unhealthiness have retarded development of the plains and valleys. The first of these opposing influences is very apparent in the figures for the East Satpuras, the second, in those for Assam and Burma. Deducting these three tracts, only one-tenth of the total area enjoys a rainfall above the general average, but this section contains nearly three-tenths of the total population. Another point of interest is the highly irregular distribution of the population, and the consequent want of significance in the mean density-figure for the country as a whole. This question has been examined in detail in the *Journal* of the Royal Statistical Society for December, 1904, where it is shown that 73 per cent. of the area has a density of only 76 per mile, whilst the remaining 27 per

cent. supports no less than 407 on the same unit. The inclusion in the last census of the sparsely peopled tracts of Baluchistan and the Burma frontier hills reduces the mean density of India from 188 (not 163, as is wrongly given in the report) to 170 per mile. From the economical point of view, Baluchistan, the Indian desert, and the Shan hills, with from 4 to 25 inhabitants per mile, may not be thinly populated, considering the scarcity or infertility of the arable land; whilst Lower Burmah, with 25 to the mile, is certainly so, since the Burman, whose industry is not his strong point, manages to export twice as much food-stuff as he raises for his own consumption on a comparatively lightly tilled area; and even in Bengal, with from 450 to 900 per mile, the limits of the expansion of population, though probably nearly approached, have not yet been attained. In a community mainly agricultural, which, as the report shows, is generally averse from migration either to other regions or to other industries, the test of economic density is, to a large extent, the movement of the population—a subject which Mr. Gait has analyzed comprehensively and with great skill. It is pointed out that hitherto, not only famine, but the improvement in accuracy of the enumeration, has prevented the establishment of anything like a normal rate of growth amongst the population of India as a whole. The first general census followed upon severe famine, and suffered, also, from inexperience in the operations; the second bore the marks of ten years of unusual agricultural prosperity; whilst the third, like the first, recorded the effect of periods of severe distress. The general impression made by the analysis of the three enumerations is that even at its best, and in spite of its high birth-rate, the population of the long-settled tracts of India increases at a comparatively slow rate, and it is only in the more recently settled provinces, such as Burmah, that the rate of growth is really rapid. The bulk of the additional burden, it must be remembered, falls upon means of subsistence bounded, elsewhere than in the latter tracts, by natural limitations, and intensive cultivation by which the evil days of congestion are staved off, though gaining ground in some respects, is still far from having penetrated to the core of Indian agriculture. There is, accordingly, a good deal in favour of moderation in the rate of increase. The deplorable set-back of the recent famines, which were of an extent unparalleled for many generations past, is, as might have been expected, the *leit motif* of the greater part of the reporter's comment upon the returns, and colours the statistics of the greater part of the country with its sad tale of loss among the very young and the very old, among the men rather than among the women, among the peasantry and village artisans rather than in the cities and their factories. On the other side of the shield will be seen the record of the amazing recuperative power of the masses, the success with which the State relief measures retained them in their homes and on their land, and their decreasing reluctance to engage in any other but their traditional means of livelihood, when their interests dictate such a transfer of their docile and industrious faculties. J. A. B.

REVIEWS.

EUROPE.

History of Alpine Climbing.

'Josias Simler et les Origines de l'Alpinisme jusqu'en 1600.' Par. W. A. B. Coolidge. Grenoble: Allier Frères. 1904. Pp. xxii., cxcii., 308, 328, and 100. *Price* 25 *fr.*

This important volume will find a place on the shelves of all those who are interested in the story of the Alps. Its author, or rather compiler, Mr. W. A. B.

Coolidge, is well known to all climbers and students of Swiss history as one of the highest living authorities on all matters connected with the history of the Alps, the exploration of their heights and recesses, and the records and literature connected with these subjects.

In the present volume he has reprinted, translated, and annotated the 'De Alpibus Commentarius' of Josias Simler, first published in 1574. This forms the kernel of the work. But in order to make it a complete record of Alpine exploration up to A.D. 1600, Mr. Coolidge has added a number of early documents, some of which are here printed for the first time. Amongst these are the ascent of Mont Ventoux by Petrarch; ascents of the Rochemelon, the Mont Aiguille, of Monte Bo by Leonardo da Vinci; Pilatus, the Stockhorn, and Niesen by Swiss savants. We find also a very curious description of the peaks of the Bernese Oberland written in 1577, and a catalogue of the passes leading into Val d'Aoste known in 1691–4.

In a lengthy introduction the author supplies an historical sketch in which he brings together from various sources details which may serve to throw light on the early condition and knowledge of the Alps. A life of Simler is added. This sketch and the copious notes contain a mass of information on the ancient geography of the Alpine region, and probably no one but Mr. Coolidge could have compiled them so well; certainly, no one living could have brought so large a knowledge, both literary and topographical, to the task.

We trust the book may be reissued in England in a somewhat more convenient form. The bulk of the first edition is, perhaps, exuberant, and the system of pagination seems somewhat intricate. But these trifles will not deter any reader who takes a serious interest in the matter in hand from following Mr. Coolidge's masterly treatment of it.

ITALY.

'Italy: a Popular Account of the Country, its People, and its Institutions.' By Prof. W. Deecke. Translated by H. A. Nesbitt, M.A. Swan Sonnenschein. 1904. Pp. xii., 485.

This is a very excellent book of a type rather too rare in English, namely, a general description of a country in all aspects, on the geographical basis. Prof. Deecke deals first with the broad physical characteristics both of the Italian peninsula and of what may be called its appendages, namely, those islands which continue the ridge of the peninsula towards the African coast, and Corsica and Sardinia as forming part of a subsidiary ridge, and the neighbouring seas. He then passes to a detailed consideration of the relief of the whole region—geology, climate, and hydrography, *flora* and *fauna*. Successive chapters deal with the people, its history, industries, and commerce, political institutions, Church, and arts. Finally a detailed topography is given, conveniently divided into sections, from Lombardy to Sicily, the Maltese group, and Sardinia. It is of the external relationship of this section to the rest of the work that criticism may be offered. To arrange the subject-matter of a book of this sort in such a way that no section shall unduly anticipate another must be a difficult matter, and perhaps it was thought well that a close topographical account should be deferred to the end for this reason. But this section is so largely an elaboration of the first section on physical geography as constantly to carry the mind back to it, and perhaps the two might have been more intimately connected. Again, when a work of this kind is set upon a foundation of physical rather than political geography, it is generally well to follow the physical rather than political division throughout. If this be granted in the present case, it is a pity that Corsica has been omitted from the topographical section, whereas Sardinia receives full treatment. The only

apparent reason for this omission is the political reason, but then, again, Prof. Deecke deals with Malta. As regards the book at large, it must always be difficult in a general work to keep strictly within the bounds of intelligibility to the class of reader in view. On this ground the book is almost unexceptionable, but (if only on this ground) a sentence here and there is open to criticism, such as this: "Many of the Alban streams possess marked polar magnetism, apparently induced by that of the earth, though possibly due to lightning;" or this: "Weak traces of ebb and flow are to be recognized in the larger lakes." The main faults of the book, however, are not in its matter, but in its production. They include the use of the German diagrams—always undesirable, and especially so in meteorological maps, for example, where the measurements are metric. In one case the thermometric scale is even left to the imagination. This defect and the occurrence of a careless error in the embossed title on the cover are balanced by some excellent illustrations from photographs. O. J. R. H.

Climate of Vienna and Lower Austria.

'Klimatographie von Niederösterreich.' Von Julius Hann. Herausgegeben von der Direktion der K. K. Zentralanstalt für Meteorologie und Geodynamik. Pp. 104. *With Rainfall Map.*

This volume on the climate of Vienna and Lower Austria, from the pen of Dr. Hann, is the first of a series on the climates of the different crown-lands, and may be taken as typical of the form and method to be followed in later volumes. Lower Austria belongs to a climatic region transitional between the milder types of Western Europe and the severely continental climates found immediately to the eastward, even in Galicia and Hungary. It is crossed by the mean annual isothermal of 50° Fahr., the mean winter isothermals 30° to 34° Fahr., and the mean summer isothermals 68° to 70° Fahr. The mean annual range of temperature at elevations less than 600 feet is 36° to 38° Fahr.; it diminishes with increase of height above sea-level. The average yearly extremes of temperature differ by 72° to 90° Fahr. The mean daily range of temperature is 13° Fahr. for the year, —7°·6 Fahr. in December, and 16°·4 Fahr. in July and August. The most rapid daily changes are due either to sudden thaw after severe frost or to thunderstorms on hot afternoons; a change of 43° Fahr. was experienced on one day in 1850, and of 38° Fahr. in 1902. Tables of departures from the mean values of the fifty years 1851–1900 are given for monthly and yearly temperatures. The coldest winter was that of 1830 (11° Fahr. below mean), and the warmest summer 1811 (5° Fahr. above the mean. The coldest month in Vienna during the last 125 years was December, 1840 (15°·3 Fahr.), and the hottest August, 1807 (77° Fahr.). The coldest year for the whole period was 1829 (44°·2 Fahr.), and the warmest 1797 (52°·5 Fahr.). The average number of days in the year at Vienna without sunshine is seventy-five, of which only four occur in summer. The longest nearly sunless period recorded was from the beginning of December, 1903, to February 6, 1904, with only thirty-one hours' sunshine in seventy days. This occurred with high barometric pressure, calm or light south-easterly winds, and fogs intensified by the smoke of the city. The month of July, 1894, gives the highest sunshine record, with 321 hours.

In the twenty years 1881–1900 the wettest year was 1897, with 115 per cent. of the average, and the driest 1891 (84 per cent.). One-sixth of the annual rainfall in Vienna falls in the form of snow. The number of thunderstorms varies within the wide limits 10 to 31 in the year.

The prevailing wind is from the west; northerly winds are frequent in the early part of the year, and easterly and south-easterly winds in spring and autumn. Southerly winds occur most frequently in October and November.

ASIA.

Ethnological Investigations in Netherlands Borneo.

'Quer durch Borneo: Ergebnisse seiner Reisen in den Jahren 1894, 1896–97, und 1898–1900.' Von Dr. A. W. Nieuwenhuis. Vol. i., with 97 Photographic Plates and 2 Maps. Leiden: E. J. Brill. 1904. *Price* 21*s*.

The present volume deals with Dr. A. W. Nieuwenhuis' journey from Pontianak, on the west coast of Netherlands Borneo, to Samarinda on the east coast, and contains a description of the Bahaus on the Kapuas and Mahakam rivers. A forthcoming volume will give an account of the expedition to the Kĕnyas of the mother-country of the Bahaus, with fuller descriptions of the industry, trade, houses, and art of these people.

In 1893–4 the first expedition was sent out by the Society for the Advancement of Scientific Investigation in the Netherlands Colonies to Central Borneo. This step was taken because it was realized that a furthering of the knowledge of the land and people must also give very important political information. The expedition made large collections of geological, botanical, zoological, and ethnological specimens, and as Dr. Nieuwenhuis was so rarely required to doctor the others, he was free to study the natives by living amongst them.

Formerly the inhabitants of Borneo were classed (1) as Dayak, the original inhabitants, or (2) as Malays, the immigrant people; the former were said to live inland, and the latter on the coast. On the whole this division is correct, but here and there, as in Sarawak, the heathen people occupy the land up to the coast. On the other hand, peoples calling themselves Malays live far in the interior up the great rivers. These two groups of people are never sharply divided, but have greatly intermingled; hence, natives who are nearly, or quite, of pure Dayak origin and belong to a religion which means far more to a heathen Dayak than Mohammedanism, call many places by true Malay or Mohammedan names. One also finds, but possibly more rarely, a Dayak in whose veins Malay blood flows.

In Central Borneo there is a brachycephalic and a dolichocephalic (Indonesian) group. To the former belong the Kayans, and to the latter the Ulu Ajar Dayaks on the Mandai. From an ethnographical point of view, also, the differences between these groups are very marked. The Kayans belong to the great group of Bahau and Kĕnya stocks of East Borneo. Dr. Kohlbrügge argues from the measurements that the Kayans are a mixed people. This is true, as they migrated 150 years ago from their original land of Apu Kayan to the Kapuas, where they mixed with neighbouring races. The Ulu Ajar are considered to be the race which, known as Ot-Danum and Siang, occupy the upper waters of Melawi, Kahayan, and Barito.

In addition to these two large agricultural groups, there are in Central Borneo numerous nomadic hunters, who, under the names of Punan, Bukat, and Beketan, live in the high mountains and at the sources of the great rivers. They appear to be older than the other two groups, and may well be the aboriginal inhabitants of Borneo. Like the Bahaus, the Kenya have for their common mother-land the district, at the sources of the Kayan, or Bulungan, river, which is called Apu Kayan or Po Kedjian.

In this interesting and very beautifully illustrated volume a great deal is given about the beliefs, customs, and handicrafts of the Kayans which it is impossible to particularize. Considerable space and many illustrations are devoted to the interesting and important subject of tattooing, and Dr. Nieuwenhuis gives data whereby the tribe of a person can be told by the designs or patterns tattooed. Those of the women, he points out, are of more reliability than those of the men, as the latter may have travelled and obtained new designs. The author classifies

the tattooing in three groups—(1) Bahau, Kenya, Punan; (2) Bukat, Bĕkĕtan; (3) races from Barito and Mĕlawi and the Ulu Ajar of Mandai. The designs of the first group are in lines. The women decorate the lower arms, hands, ankles, and feet; the men the shoulders, arms, and breast; the thumb of the left hand and the ankles are decorated only on very brave men. The men of the second group tattoo the whole of the body from the lower jaw to the knuckles and ankles with a blue background, so that the patterns are left in the natural skin colour. If a Bukat youth distinguishes himself in war, or in any other way, he is first tattooed on the breast with a triangular figure; later other parts of the body are decorated in regular order according to prowess. The men of the third group begin with discs on the calf; and later, unlike the first group who have isolated figures, the arms, rump, and neck are completely adorned by designs of figures that are joined together. The women chiefly decorate the knees, lower legs, and hands. The second and third groups tattoo free-hand, whilst the first group tattoo by following the impressions of wooden blocks. The third group employ a red colour as well as soot. In the first and second groups the women, and in the third group the men, are the tattooers. There are many taboos connected with tattooing.

The rice-sowing festival frequently does not fall on the same day as the actual sowing. Dr. Nieuwenhuis describes how, at a Mahakam Kayan village, the festive day was appointed by an old priest by the position of the sun in the following way: he had near his house two elongated stones, one large, the other small, and he noted the time at which the sun set at a spot on a certain hill in alignment with the two stones. The rice-sowing festival was the only one which he determined by astronomical means. For the most part the reckoning of time by the Kayans is more or less arbitrary, and depends upon agriculture. The month, or, as they say, the moon, is more important than the year, and hardly any one knows how many moons go to the year.

The natives of the interior of Borneo are a peculiarly pleasant people to visit, with their quiet politeness and self-respecting friendliness. Though they are agriculturalists, they are warlike, a circumstance that is doubtless partly due to the fact that they grow little else but rice, which gives comparatively little trouble and leaves leisure for forays; and partly to the propinquity and extent of the jungle, which enables the men to retain their hunting proclivities and educates them to tackle human game. A very noticeable feature of the non-Malay tribes is their artistic sense, which manifests itself in the pleasing decoration of most of their implements in daily use. This sumptuously illustrated volume can be thoroughly recommended as giving a good insight into the conditions of existence in one of the most interesting spots of the globe, and one, too, that has hitherto escaped the blighting influence of the white man.

A. C. HADDON.

AFRICA.

THE SAHARA.

Documents Scientifiques de la Mission Saharienne, Mission Foureau-Lamy . . ' Par F. Foureau. Première fascicule: Introduction; Observations Astronomiques et Météorologiques. (Publication de la Société de la Géographie.) Paris: Masson. 1903. Pp. 162.

The "Narrative" of M. Foureau's great journey across the Sahara appeared in his book, 'De l'Alger au Congo par le Tchad' (see *Geographical Journal*, vol. 19, p. 196). The scientific results of the expedition are to be published in six parts—astronomical and meteorological observations; orography, hydrography, and topography; geology; flora and fauna; ethnography; and prehistoric remains. Of

these parts, which will together form a volume of 800 to 1000 pages, and an atlas of 16 maps, the first has been issued, and the others will apparently follow in the order named. The astronomical observations were made by M. Foureau himself, and by M. de Chambrun; they have been reduced and discussed by M. Guyou, President of the Bureau des Longitudes, and give the positions of over a hundred points on the route of the expedition. The results of magnetic observations by M. Foureau are also given.

The meteorological observations consist of readings of aneroid barometer and thermometer thrice daily, observations of hypsometric thermometer at selected points for correction of the aneroid, observations of self-registering thermo-hygrometer, observations of wet and dry bulb thermometers at certain stations, and the usual "eye-observations" of wind, cloud, etc.

For purposes of discussion, the region traversed by the expedition is divided into four climatic zones: (1) the Sahara and Aïr zone, between 32° and 49° N. lat.; (2) Aïr zone, lat. 20° to about 15° N.; (3) Sudan, Tchad, and lower Chari zone, lat. 15° to 12° N.; and (4) sub-equatorial and equatorial zone, lat. 12° N. to the equator, Chari, and Oubangi region. The number of observations in different zones is, of course, differently distributed according to the season during which the expedition found itself in each, but the experiences of the expedition are of peculiar interest, both in affording information about the climatology of an almost unknown region, and in throwing light on the general meteorological *régime* occurring in a type of climate of which we have comparatively little actual knowledge. In the Sahara and Sudan we find a belt extending from the "horse latitudes" to the "doldrums" in a land area of vast extent, but without definite lines of great elevation. The range of temperature is enormous—the expedition records temperatures below freezing twenty-five times, and at the camp at Ouad Affattakha (lat. 25° 16′ N., long. 5° 25′ W., altitude 3753 feet) the thermometer went down to 13°·6 Fahr.; in the Aïr region the mean temperature during June was 99° Fahr., and the daily maximum for May and June never fell below 107° Fahr., nevertheless winds are irregular in distribution and force. Want of vapour-supply prevents the full development of the trade winds, which were not recognized beyond Abellama, in lat. 16° 17′ N., and in the absence of a definite line of elevation the monsoon does not attain strength and coherence. Hence the relative importance of dust-whirls, tornadoes, and similar local phenomena, of which this memoir contains some interesting records, and the characteristic division of the rainfall into defined rainy seasons and accidental showers associated with the local disturbances. The work of the expedition makes a valuable contribution to our knowledge of a typical "continental" climate in the tropics.

A West African Vade-Mecum.

'*Verb. Sap.* on going to West Africa, Northern, Southern Nigeria, and to the Coasts.' By Alan Field, F.R.G.S. London: Bale, Sons, & Danielsson. Price 2*s*. 6*d*.

This little book, of which an advanced copy has been sent us, should be of great use to travellers about to make the acquaintance of West Africa for the first time. It consists of practical hints on outfit, and information on a variety of subjects connected with life and travel in the West African colonies and protectorates, which it is important for the intending visitor to possess, but for which he may search in vain in published works on those countries. Being concerned with one special region, it can, of course, enter into details which the more general scope of the Society's 'Hints on Outfit' would render unsuitable, and it therefore forms a useful supplement to the latter. Chapter II. conveys much practical information in the form of an imaginary voyage from Liverpool to Lokoja, while

other chapters deal with "Health, Climate, and the Seasons," "The Life and Social Amenities," and other subjects.

AMERICA.

The Argentine and Chile.

'The Countries of the King's Award.' By Colonel Sir Thomas Hungerford Holdich. Hurst & Blackett, Ltd. 1904. Pp. xv., 420. *With Map. Price* 16*s. net.*

To the author of this book fell the difficult task of evolving from the language of treaties based on a fundamental misconception of the configuration of Patagonia, a boundary between the possessions of the Argentine and Chile, that should form a reasonable settlement of their rival claims. The reader will here find the conditions of the problem clearly set before him, as well as the outlines of the solution which has been so successful in terminating for good the differences which had disturbed the relations of the southern republics.

To the student of political geography, the most instructive chapter will be that in which the author discusses the question of the natural features with reference to which a boundary may be defined, and the terms that should be used in describing them—a chapter which deserves careful study by diplomatists who have to agree upon the course of a frontier in a region whose geographical features are still imperfectly known.

We are given a brief but interesting description of the territories of the two states whose future appears so promising now that the spectre of a protracted and sanguinary war has been happily banished, as well as a sympathetic appreciation of the national characteristics of the inhabitants. The author appears to have been impressed by the efficiency of the naval and military forces of the republics, and devotes some space to the records of the achievements of the navy of Chile in the war with Peru, doing justice at the same time to the heroism of the opposing commander Grau and his comrades. Fortunately, however, the marvellous agricultural development of which the author tells us is of more interest to-day in these southern lands than battleships or armies.

In Patagonia itself the author has had unique opportunities of making himself acquainted with the magnificence of its scenery and the extent of its resources. Both states placed their men-of-war, which on this occasion at least well served the cause of peace, at his disposal, and on land all the resources of the country were drawn upon to facilitate his movements. We have some vivid pictures of his voyage among the intricate channels and fiords of the west coast, whose shores are clothed with exuberant vegetation save where the glaciers from the mountains reach the sea. Then the scene changes to the still grander beauty of Tierra del Fuego, once a synonym for desolation, but which, it now seems, is admirably adapted for sheep-farming.

The chief interest, however, of the book centres in the disputed territory, the succession of fertile and picturesque valleys that have long been hidden away between the Andes on the west and the forbidding pampas of eastern Patagonia. In the deeper hollows lie great lakes that outflow sometimes to the Atlantic, but more frequently through the Andes in deep valleys which are rendered impassable by the close-grown vegetation. The author gives us a graphic description of his extended ride through this region amid the rains of the late autumn, till, on the arrival of winter at last, he turned eastward, and with the snow driven by the tireless western winds at his back, made his way across the pampas to the Atlantic coast. It is difficult to imagine a reader possessed with any vestige of the spirit of travel who does not long to pay a visit to this new wonderland of the southern hemisphere.

The numerous illustrations, which are reproduced from photographs, are excellent. Though they are in most cases printed with the text, the definition is far superior to that of many plates, and wherever the figure of the author appears, however small it may be, the likeness is unmistakable.

J. W. E.

GENERAL.

History of Cartography.

'Kartographische Denkmäler zur Entdeckungsgeschichte von Amerika, Asien, Australien, und Afrika aus dem Besitz der Königlichen öffentlichen Bibliothek zu Dresden.' Herausgegeben von Victor Hantzsch und Ludwig Schmidt. Hiersemann. Leipzig: 1903.

This series of facsimiles includes seventeen excellent illustrations of the map-work of three prominent sixteenth-century draughtsmen, viz. (1) the chart of the Atlantic Ocean basin, by Pero Fernandez, 1528; (2) the 1541 world map of Nicolas Desliens, in three sheets; (3) the extra-European portions of Diego Homem's work of 1568, in thirteen sheets.

As to Pero Fernandez, it is impossible to decide whether this designer is the same as any of the well-known men who bore this name in the great age of Portuguese history; we only know what he tells us on this map—that he executed the present work at Oporto in 1528. But he may have been the same as the Pero Fernandez who in 1558 was commissioned by the King of Portugal (Sebastian) to supply maps and nautical instruments for ships sent to Guinea and India in the service of the state. The original is in MS. Dresd. f. 17; its measurements are 0·88 by 0·64 metre, the height being the larger dimension. The African coast is only shown a little beyond the mouth of the Congo. Great castle pictures mark the fortress of La Mina on the Guinea coast and the capital of the Congo kingdom.

As to Desliens and his work, we do not suffer here from the vagueness that clouds Pero Fernandez. Next to Pierre Desceliers, Nicolas of Dieppe is the leader of that great Norman school of cartography, whose importance was first adequately appreciated by Henry Harrisse; next to the priest of Arques, he is the father of French map-science. The specimens of Desliens here given from the Dresden MS. Geog. A. 52 m. (0·575 metre in height by 1·042 metre in breadth), inscribed *faicte à Dieppe par Nicolas Desliens*, 1541) are claimed by the present editors as earlier than the so-called Harleian map in the British Museum (Add. MSS. 5413), which the late Mr. Coote endeavoured to assign to 1536, considering it as the oldest surviving production of Dieppese cartography. In any case, its resemblance to the Harleian example is most intimate; slighter, but still beyond dispute is its likeness to the "Cabot" map of 1544—a distinctly inferior production of the Dieppe school, but of the Dieppe school nevertheless.

As to Diego Homem, he is probably a son of that Lopo Homem, "mestre de cartas de marear," who received from King Manual, in recognition of his work, a *privilegium*, on February 16, 1517. Diego's life is at present scarcely better known than that of Pero Fernandez. In 1543, after committing murder, he seems to have fled from Portugal to England, and to have remained in exile (in various European countries) till 1547, when he was pardoned and recalled by John III. (July 11). Much of his later life appears to have been spent in North Italy, where Battista Agnese notices his presence, and praises his work as unusually painstaking and finished. Twenty-one maps of his are known. The present work, executed at Venice in 1568, was formerly in the possession of Count Heinrich Brühl, and since 1798 has been in the Dresden Royal Library (MS. Dresd.

f. 59 a). On the third sheet is the endorsement inscription of the author: *Diegus Homē Cosmographus Lusitanus fecit Venettis ano a partu Virginis* 1568.

The works of Pero Fernandez and Diego Homem probably drifted into the possession of the Elector Augustus of Saxony (1553–1586) through the commercial relations cultivated by the latter with Portugal. In 1576 Hieronymus Kramer was sent from Dresden to Lisbon to procure openings for Saxon trade, and in particular to secure direct access to the spice and drug markets controlled by Portugal. Kramer made numerous and valuable purchases for the elector; and in the same way the great Augsburg merchant Konrad Rott, who had temporarily leased from the Portuguese Government the Indian pepper monopoly in Lisbon, and who had met Kramer in Portugal, made himself a commercial and antiquarian agent of the Saxon prince, whose aid he desired in various projects of his own.

The map of Pero Fernandez here given seems to have been noticed in the oldest catalogue of the Electoral collections at Dresden (the 'Inventar der Kunst-Kammer,' drawn up in 1587). We know that before his death in 1586, Augustus had acquired thirteen cosmographical and cartographical works, considered even then as valuable; but the only precise indication of such an acquisition in the records of his life is the present of a compass and sea-chart from Duke John the Elder of Schleswig-Holstein, on March 29, 1575.

As to the details of the map-work here reproduced, we may notice in the Desliens example (plates 2–4 of the present facsimiles) that, as in the "Harleian" map, *Iaua la grande* is prominent and distinctly suggests a discovery of certain parts of the north-west of Australia before this date (1541); that the Caspian is quite misconceived, its length being indicated as from west to east; that the whole of Asia east, north, and north-east of the Caspian is obviously unknown to the designer; and that the Don is really his limit on this side of the world. For though an estuary is indicated in that part of the Caspian shoreland which roughly answers to the Volga delta, there is no hint of a great river, and throughout the eastern and central portions of the present Russian empire, Desliens' conceptions are far inferior to those of Herberstein (1517–1526), just as on the Pacific coast of Asia his delineations are decidedly in arrear of the knowledge already acquired by the Portuguese. In the north-east of North America, Desliens' present work has a striking likeness to the "Cabot" map of 1544, which may be fairly supposed to owe a great deal to Nicolas of Dieppe. In the southern parts of Africa and Asia, and along the shore-lands of Africa, the Norman draughtsman furnishes an excellent picture of the most advanced geographical knowledge of his time.

C. Raymond Beazley.

Geographical Terms.

'Dictionary of Geographical and Topographical Terms.' By Alexander Knox, B.A. London: Stanford. 1904. *Price* 15*s*.

Readers of books of foreign travel are constantly confronted with difficulties in regard to the place-names and topographical terms met with, a right understanding of which involves a greater or less knowledge of a host of out-of-the way languages. Mr. Knox's book is an attempt to remove such difficulties, by the definition of the terms most commonly employed throughout the world for geographical and topographical features, as well as of words in frequent occurrence in the composition of such terms or of place-names. Its interest is therefore obvious at first sight, and, though it lays no claim to completeness, and will be of use rather to the general than to the scientific reader, geographers may still be grateful for the amount of persevering labour bestowed on its compilation, which must have involved difficulties of no light order. Especial attention has evidently been

given to the terms in use in the various African languages (Arabic, Bantu, Somali, etc., etc.), but the various Asiatic groups take likewise a prominent place. Chinese place-names, formed as they are almost entirely from words in ordinary use, benefit in particular from such an explanation of their component parts, though they at the same time offer special difficulties from the impossibility of discriminating, with the English alphabet, between the slight differences of pronunciation which involve entire differences of meaning. Thus what is apparently the same term frequently appears with several distinct meanings. Mr. Knox has, perhaps wisely, made no definite choice between the various systems of transliteration of Chinese, but repeats many of the terms under the different spellings in use (e.g. *kiang* and *chiang*, *chou* and *chau*). It is, perhaps, to be regretted that in such cases he does not specify the parts of the country in which the respective forms are used. The many variants of the first element in the name Sechuan or Suchuan are not entered, though some of them are referred to in the introduction, in which Prof. Keane gives a learned disquisition on the principal consonantal changes which occur in the various groups of languages. Mr. Knox does not devote much attention to precise definition of meaning from the point of view of physical geography, and though by bringing together such a vast number of terms he has simplified the task of future workers in this field, his book still leaves as a desideratum the authoritative list of technical terms in use in geography, the compilation of which has for some time been under consideration by our Society, and has quite recently been taken up in America by Prof. Abbe. Much less attention is avowedly given to European than to extra-European terms, and while many of the former are altogether missing, the definitions of others, *e.g.* "cañon," "scar," "Schollenland," etc., etc., frequently lack scientific precision or completeness. The points of the compass in different languages might also have received fuller attention. But in its own special field the book will be a useful work of reference to the geographer.

THE MONTHLY RECORD.

THE SOCIETY.

Geography in Military Education.—The importance of a thorough study of geography to military officers lately received cordial recognition from Mr. Arnold-Foster, Secretary for War, in a speech which followed the first of a course of lectures on "Military History and Strategy," delivered at the University of London by Colonel H. A. Sawyer on January 16. After expressing his wishes for the success of the enterprise inaugurated on that occasion, and touching upon the general needs of the army as regards education, he said that he should like to see young men come up from the public schools instructed in the great science of geography. Now they come up practically without any knowledge whatever of one of the sciences which, more than any other, was the reasonable foundation for the studies of an officer in the army. He hoped the reorganization of the army might subserve a great purpose in this matter, and that more might be done in the future than had been done in the past to encourage the study of geography. At present it was a special subject in the Staff College, and knowledge

of it was required by the authorities at Sandhurst and Woolwich. But it had been urged on him by many competent authorities with whom he was in agreement that the War Office might encourage the study of geography in the public schools if a reasonable knowledge of the subject were demanded in the preliminary examinations for entrance to the army. There was an extraordinary lack in this country—which of all others ought to be well posted in this branch of science—of a proper knowledge of geography. Such words from one in Mr. Arnold-Forster's position are a happy augury of future success in this direction. In connection with this gratifying statement, we wish to state that in the summary of the correspondence in the *Times*, published in the January number of the *Journal*, we had no intention to endorse all the charges made by the *Times* Military Correspondent. With regard to the Intelligence Department, it is pointed out that it is not a publishing department, and that it is conceivable that, under certain circumstances, the publication of information in the shape of maps or otherwise might be indiscreet and cause breach of neutrality. No reference, moreover, was made to the excellent work done at the Chatham School in training for survey and cartographical work.

EUROPE.

The Vatna Jökull, Iceland.—This great snowfield, the largest in Europe, was crossed last summer for the first time from east to west by Messrs. T. S. Muir and J. H. Wigner. Their equipment was conveyed on two sledges, and ski were found of great service, especially on soft snow. The length of the route was about 80 miles, and excursions on either hand from different camps made up as many more. From Faskrudsfjord, on the east coast, they rode in five days to a point on the north-eastern margin of the Jökull, about 5 miles south of Snaefell. Here they dismissed guides and ponies, and, after a week spent in preparations and reconnoitring, they finally left the northern margin on August 13. They proceeded in a south-westerly direction, until approaching the southern margin, when they turned more to the west to avoid the outliers of the Öraefa Jökull. On the 22nd they crossed the main watershed at a height of about 5000 feet above sea-level. Traversing the magnificent *névé* of the Skeitharar Jökull, they reached on the 26th the crater Graenafjall, situated on the south face of Hágöngur, the second highest measured peak in Iceland. Here they remained encamped in a cave for six days, during which the weather was extremely broken. Hágöngur, however, was climbed, and the fine glacier lake, Graenalón, examined. On September 3 they got off the Jökull near one of the sources of the Djupá. Two days later, after encountering considerable difficulties, they found the farm of Nupstathr, whence, having procured guides and ponies, they travelled to Reykjavik. On the northern margin the upward slope was very gentle, but, in the first instance, the numerous and large surface streams, and later the softness of the snow, made the labour of hauling the sledges very great. In fact, it was only by taking them on one at a time that any progress at all could be made. It was only after the first storm that the new snow made it possible to take both sledges on together. Very soon it was found that the best way was to sleep during the day and travel by night. Then, however, fog proved a great hindrance, making steering extremely difficult. The first crevasses of any size were met with at the head of the Breithamerkr Jökull, near

the southern margin. These were threaded in semi-darkness, and proved merely a welcome change from the monotony of the otherwise featureless snowfield. The whole interior of the Jökull, indeed, is a vast plateau varying in height from 4000 to 5000 feet above sea-level, unbroken except at the edges and near the western margin by a single rock peak. During the last two days considerable trouble was caused by crevasses, which were long and wide, and the route, therefore, was a succession of zigzags. The weather conditions were on the whole as favourable as could be expected. Two snow blizzards were experienced, but those, though causing delay at the time, provided compensation in the covering of new snow, which afforded a better surface for the sledges. The highest temperature recorded was 38°·8, and the lowest 22°·3, the average being about 30°. The prevalence of fog and the ceaseless winds, as well as the marked general humidity of the air, made the cold seem much greater than it really was. As Messrs. Muir and Wigner were alone, and so had to do all the mere manual labour, small leisure remained for purely scientific observation. However, a large number of photographs were taken, and a meteorological record kept. With the aid of pocket-sextant, compass, and sledge odometer (the latter being tested in all conditions of snow), a fairly accurate route survey was made out. The standard map by Thoroddsen, which has deservedly received high praise as regards the rest of the island, could not be expected to be accurate in respect to the Vatna Jökull. It is impossible here to enter into details, but numerous important discrepancies were observed, not only, as was natural, in the unknown northern region, but in the more frequented southern district. Last summer the southern margin was surveyed by a Danish staff, but the northern and western margins would well repay careful and systematic examination, both from a geographical and a geological standpoint, and especially with a view to studying the remarkable volcanic and glacier phenomena.

Age and Origin of the Würm See, Bavaria.—The origin of this lake (called also the Starnberger See) has been attributed by Penck to glacial erosion, a view which has found an opponent in Dr. W. Ule, of Halle-am-Saale. In his work, noticed in the *Journal* a little time back (vol. 19, p. 381), Dr. Ule gave reasons for doubting Penck's conclusions, and he now claims (*Zeitschrift* of the Berlin Geographical Society, 1904, No. 9) to have found further reason for holding that the lake-basin has not been formed by ice. It consists in the discovery of further evidence of the existence of an old delta covered over with morainic matter at the southern end of the lake, which would show that a lake must have existed here *before* the last glacial period. This fact would also eliminate the difficulty of finding a stream capable of having formed the delta, the old hydrographical system having been greatly changed during the last advance of the ice. Dr. Ule also holds that it is unnecessary to account for the existing hydrographical conditions in this region by supposing (as has been done) a post-glacial movement of the crust, which, he says, is rendered improbable by the fact that the delta alluded to appears to have suffered no disturbance. He concludes by sketching the probable mode of origin of the lake-basin by river-erosion during an early inter-glacial period, followed by deposition of material in the form of a dam during a subsequent advance of the ice.

ASIA.

The Jammu Coalfields.—A comprehensive report, by Mr. R. R. Simpson, on the Jammu coalfields of North-West India, appears in the *Memoirs of the Geological Survey of India*, vol. 32, part 4. The feasibility of exploring the coal-bearing beds in the Jammu hills had been for some years past under consideration, and the question was recently accentuated through the revival of the project of a railway to

connect Jammu and Srinagar cities. The coal-beds lie between 33° and 33° 11′ N. and 74° 35′ and 75° 13′ E., in Jammu State, and within 35 miles of the Jammu-Punjab boundary. Ladda, the south-easternmost of the coalfields, lies 21 miles north-north-east of Jammu city, the nearest point on the North-West railway. The strike of the coal-bearing rocks cuts obliquely across the hill ranges between 3000 and 9000 feet, with a general east-to-west trend, and the coal outcrops are, as a rule, found in or near the stream-beds. The only made road in Jammu state, 44 miles long, between Jammu and Udhampur, passes within 7 miles of the prospecting drives in Jungle gully. Mr. Simpson's investigation, carried out between March and May, 1903, was not the first that had been made, the region having been the subject of a note in the Records of the Survey (vol. 9, part 2). In 1901 a Public Works officer instituted prospecting operations, since continued under his supervision, in Ladda coalfields, and different parts of the region have also been explored by others. The only two coalfields possibly workable at a profit are, Mr. Simpson concludes, the Ladda slope, approached through Tikri and Mutal; and the Anji valley, approached through Riassi. Of these two, the former has the advantage that the cost of transport thence to the Tawi would be over 40 per cent. cheaper than from the latter. The output of Ladda collieries, Mr. Simpson would, everything considered, rate as low as 50,000 tons per annum, and he calculates that the coal carried thence by a 2-feet 6-inch gauge railway would sell at Wuzirabad at a loss per ton of R3 2*a*.—an annual loss of 48 per cent. on a capital of 35 lakhs; or, if the line were worked by bullock traction, of rather less than R1—an annual loss of 4 per cent. on a capital of 12½ lakhs. The Anji valley coal would, he thinks, involve still greater loss per cent. on the necessary outlay, whether an independent line were constructed or merely a branch joining the proposed Jammu-Kashmir line at Talwara. The working of the Jammu coalfields he therefore considers to be, in present circumstances, a proposition not commercially sound.

Winter Journey in Western Sechuan.—M. Bons d'Anty, French consul at Chengtu, briefly describes in *La Géographie* (vol. 10, p. 317) a winter visit to Mount Omi and the borders of the independent Lolo country, made in company with Dr. Legendre, M. Philippe Berthelot (son of the well-known scientist), and the wife of the latter. The routes do not appear to have led over any ground not previously trodden by Baber, Little, etc., but it is claimed that the ascent of Omi had not previously been made by a European, certainly not by a lady, in winter. The upper half of the mountain was buried in thick snow, with a frozen surface, and only the use of straw sandals enabled the travellers to keep their footing. Only Tibetan pilgrims were met with on the mountain, the winter being the season expressly chosen by them for their pilgrimage to Sechuan. A visit was afterwards paid to a Lolo village on the right (south) bank of the Tung-ho, where these people were found to retain all their primitive characteristics, and impressed the travellers with their frank and hospitable disposition. M. d'Anty says that the proper translation of the name applied to themselves by the Black Lolos is "brown hairs," not "black bones," as it was given by Baber. These are the true Lolos, men of very fine physique, while the race of small stature mingled, and often confused, with them, seems to represent the oldest ethnic element of Indo-China.

Kiau-Chau.—An article by Dr. Berensmann, appearing in the *Zeitschrift für Kolonialpolitik* (Heft 8, Jahrg. vi.), embodies much information, practical and scientific, about Kiau-Chau and Shantung generally. The mean yearly temperature of Tsing-Tau is shown to be nearly the same as that of Bordeaux. The difference, however, between the monthly means of the coldest and the warmest month, 59° Fahr. at Bordeaux, was at Tsing-Tau, in 1898–99, 75°, and in 1899–1900, 84°. In

1898–99, Kiau-Chau territory had but ten, in 1899–1900, eighteen snowy days. In 1898–99 there were but three days of ice, all in the month of January; and even in the severe winter of 1899–1900 but twenty-four days of ice, twenty of them in January. Kiau-Chau bay is therefore never frozen, though in the severe January of 1900 drift-ice formed on the shallows and at the edge, partially and temporarily interrupting junk communication. Altitude and climatic conditions are comparatively favourable, and in any case better than at Chifu. On the whole Chinese coast Tsing-Tau is considered the most favourably situated, both as a watering-place and a sanatorium, and its visitors from Shanghai, Hong Kong, etc., have lately shown a great increase. Thanks to costly waterworks, the drinking-water is now unexceptionable. Measures of a thorough kind have been taken to cope with fever, cholera, leprosy, etc., and the newly opened hospital has already done much good work. The mountain-tops have, during the past few centuries, been denuded of wood and grass for purposes of combustion; what timber there is is mostly stunted, pine, 3 to 6 feet high, and only on sites unsuitable for tillage, in burial-places and temple groves, are there foliage trees, but these are often of splendid development. The want of timber is a drawback to the working of coal-seams. In German territory a wide area has been laid out in plantations and green crops—over 2000 acres in the vicinity of Tsing-Tau alone. For afforestation the denuded mountains need first to be supplied with soil. With the extension of the forest, birds are increasing in numbers and number of species. Though not one of the over-populated parts of Shantung, Kiau-Chau has an estimated population of 85,000, or 486 to the square mile. The non-Chinese population lives with few exceptions in Tsing-Tau, where, in September, 1903, there were 928 Europeans (180 women) and 28,144 Chinese (1694 women) against 688 Europeans and 14,905 Chinese in 1902. In the same period, Japanese settlers had increased from 79 to 108. The Chinese of Shantung are men of strong physique, tall and manly build, healthy complexion and intelligent expression, while the Chinese merchant is of "absolute trustworthiness in trading transactions." Many have picked up a knowledge of German. The capabilities of the province as regards agriculture, cattle-rearing, industry, mining, etc., are discussed in detail.

AFRICA.

Survey of the Anglo-German Boundary in East Africa.—Lieut.-Colonel G. E. Smith, R.E., who is now engaged as commissioner in laying down the Anglo-German boundary of the British East African Protectorate between Lake Victoria and Mount Kilimanjaro, has accomplished about half his work, and expects to be back in England in May or June next. Writing from Nairobi on November 22 last, he gives the following particulars of his expedition: "In the first place, it was necessary to transfer the longitude from Kisumu, the railway terminus on Lake Victoria, to the commencement of the boundary, which involved 80 miles of triangulation, besides that of the actual boundary, which is about 230 miles in length. The country between the lake and Kilimanjaro is very little known. Various travellers have crossed it by the Rift-valley, but no one has gone right along it. Burnham's journey from Nairobi to the lake came nearest to it, and Neumann has, I think, crossed from Nguruman, on the big Natron swamp, to the lake.* This country we found inhabited for the first 80 miles or so, but sparcely.

* Neumann's route led north some 60 miles from Nguruman, before striking west for the lake. Another German traveller who has traversed this region is Colonel von Trotha, who in 1896 crossed from Nguruman to Mori bay, on the Victoria lake (*Journal*, vol. 9, p. 90).

By that time we had risen some 6000 feet above sea-level, and had reached an excellent climate, with fine open grass country—some brush, but not very much. Then we descended the Isowria escarpment, which Burnham has named the 'Basalt escarpment,' but I am doubtful whether the rock there is really basalt. This escarpment runs north-east and south-west, and forms the western wall of the Ngare Dabash, or, as it is called when it has crossed the frontier and flows westwards to the lake in German territory, the Mava river. The Dabash is a fine river—in the dry season fordable in places, and some 70 yards broad, but very much larger in the rains. Leaving the Dabash, you have a long rise, diversified with considerable hills, until you reach the neighbourhood of the Rift-valley. The descent from the water-parting (altitude some 7000 feet) is at first gentle, and here also considerable hills break up the country and afford good streams. You reach the escarpment itself somewhat suddenly, and equally suddenly the country changes from open grass-country, with patches of forest, to dense forest clothing the upper slopes of the escarpment, which drops with remarkable abruptness some 3000 feet to the very level floor of the Rift-valley. Nearly the whole of the country described is well watered and affords excellent grazing. The formation is mostly a hard crystalline lava, but in places sandstone and slate appear. Reefs of quartz are frequently met with, and quartzite is common. In places this is of a pure white, and glistens like snow in the sun. So far no gold has been found in this part. Game has been very plentiful. Topi has been by far the commonest antelope, ranging from the lake to the divide before the descent into the Rift-valley. Impalla, zebra, and Jackson's hartebeest are found all over this country. The roan antelope occurs in the neighbourhood of the Ngare Dabash, and gnu (I am afraid I cannot say of what species) from the Dabash to the Rift-valley. The oribi is common at first, but appears to cease east of the Dabash. The wart-hog is numerous nearly all the way along. Rhinoceros are to be found, but judging from the fact that I have seen none, and that only one has been shot, they cannot be very numerous. Elephant's tracks I have noticed occasionally, but I doubt whether they are ever numerous hereabouts. Thomson's gazelle I first saw near the Dabash, and they have been frequently shot right up to and in the Rift-valley. Grant's gazelle I first saw on the divide near the Rift-valley. I do not think they extend further west than that; thence they become common. I have seen what I take to be the gerenuk near the frontier in the Rift-valley, but as I have not got a specimen and know the animal only by description, I am uncertain about it. Oryx (I think *O. Callotis*) I first saw in the Rift-valley. I have a specimen, so that I shall know for certain when at home what it is. The eland is found here, but is not common; a largish herd of twenty or thirty was seen about 70 miles west of the Rift-valley. Buffalo are said to be frequent, but so far only three have been seen and none shot. Giraffe I first saw when nearing the Rift-valley, and again when I entered it."

The Glacial Features of Kilimanjaro.—Prof. C. Uhlig, whose recent investigations on the shores of the Victoria Nyanza we lately referred to, has described before the Berlin Geographical Society his ascent of Kilimanjaro towards the end of 1901, and his study of the glacial features of the great mountain (*Zeitschrift*, No. 9, 1904). The paper is illustrated by a striking series of photographs, and forms a useful supplement to the work of Dr. Hans Meyer. The first ascent of Kibo was made from the east by the route followed by various previous travellers, and thus permitted a comparison of the conditions with those observed by them. At the sleeping-place at 4690 metres (15,400 feet), where snow had been met with by his predecessors, no trace of it was seen by Dr. Uhlig, and it did not begin until some 500 metres higher. At 5600 metres (18,400 feet) the snow took the form of

regular "nieve penitente," exactly analogous to the formation so designated in the Andes, though on a much smaller scale. It had not been previously observed on Kilimanjaro. Dr. Uhlig calls attention to the difference between true "nieve penitente" and the "karren"-like forms of glacier-ice, though he allows that both have their origin in the powerful action of the sun and the approximately vertical direction of its rays under the equator. The action of the wind in creating wave-like surfaces has much influence in the case of the "nieve." The final ascent to the crater was found exceedingly fatiguing, owing to the rarity of the air and the loose nature of the surface. In the crater the accumulation of snow and ice seemed distinctly greater than at the time of Dr. Meyer's visit in 1898, although the time of year (the dry season) would have rendered the converse more likely, and there were no signs of recent snowfall. Dr. Uhlig considered that a period of greater rainfall had, perhaps, set in in East Africa, though it appears that, on revisiting the mountain last year, he noticed a marked diminution in the amount of snow in spite of an unusually rainy season. The photographs give a good idea of the character of the ice within the crater, which in places took the form of vertical needles. Dr. Uhlig afterwards visited the glaciers on the south side of the mountain. He was struck by the difference between these glaciers and those of the temperature zone, a fact due, however, rather to the volcanic nature and consequent form of the mountain than to the latitude. The Kibo glaciers are not hemmed in by steep slopes, but are able to spread out laterally as they descend, and so lack well-defined snouts. The gathering ground is, of course, comparatively small, and Dr. Uhlig was surprised at the number of glaciers to which the *névé* in the crater can give rise. In the ice of the Van der Decken and Heim glaciers he observed distinct blue foliation, and he found support for the idea that this is due to the original stratification of the *névé*. The southern glaciers visited (one of which—the Richter glacier—has to be added to the list of those previously known) possess a common terminal moraine, the water finding its way through by percolation. This moraine falls some 350 feet towards the west, a fact which agrees with the greater extent of glaciation noted by Dr. Meyer in this direction. There were signs of a more or less recent retreat of the ice on this side of the mountain.

Ancient Coast-lines in Algeria.—Among the many localities where past changes in the relative level of land and sea within the Mediterranean basin can be distinctly traced, is the coast of the Sahel in Algeria, where the evidence of such changes has been carefully studied by General de Lamothe, some of whose conclusions are summarized in a note in the *Comptes Rendus* of the Paris Academy of Sciences for December 26 last. M. de Lamothe has proved the existence of seven old shore-lines, at levels varying from 17 to 320 metres (561 to 1050 feet), while there are traces of one still older, at a level of 350 metres (1150 feet). The 320-metre line seems to date from the early Pliocene, since which the coast-line has experienced a series of negative movements, which have lowered it progressively to its present level; and the fact that the successive levels agree with those established at other points on the Algerian coast shows that the successive shore-lines have rested on parallel surfaces. There are indications (*e.g.* the fact that a formation with remains of fluvio-lacustrine origin is seen to plunge beneath the sea) that the movement subsequent to the 15-metre level lowered the shore-line *below* its present level, and was followed by a positive movement. M. de Lamothe draws the following general conclusions, which are of considerable interest to students of the past geography of the Earth's surface: (1) That the regularity of the shore-lines and their agreement in altitude along the whole Algerian coast are an indication that during the Upper Pliocene and the Pleistocene, the Mediterranean was without tides; (2) that the arrangement of the ancient dunes and the

strike of their strata seem to show that the direction of the currents and prevailing winds has not materially changed since the Upper Pliocene; (3) that these facts can hardly be reconciled with the various hypotheses based on supposed periodic or accidental displacements of the axis of the Earth.

Memorial to Clapperton in Sokoto.—Major J. A. Burdon, who has returned to his post as resident of the Sokoto province, Nigeria, has taken out with him a memorial tablet, prepared at his own expense, which will be placed on the Court House at Sokoto, erected by him in 1903. The tablet has the following inscription: "In memory of Hugh Clapperton, Commander R.N., the first European to visit Sokoto, March 16, 1824. He died there April 13, 1827, and was buried at Jungevi." It may be of interest to recall that the first European visitors to Timbuktu were recently commemorated in a similar way by the French authorities, tablets being affixed to the houses in which they had resided (*Journal*, vol. 23, p. 255).

Ruins of the Songhai Capital of Kukiya.—The *Revue Coloniale* issued by the French Colonial Office contains, in the number for September—October, 1904, the announcement of the discovery by Lieut. Desplagnes of the site of Kukiya, the old capital of the Songhai empire, as to the position of which much difference of opinion has prevailed. From a passage in the *Tarikh es Soudan* there was reason to suppose that Kukiya, which was the capital of the empire previous to the establishment of the Askias at Gao, lay at no great distance from the latter, and this has, in fact, proved to be the case. The ruins lie on the east bank of the Niger, about 95 miles south of Gao, opposite the small island on which is the village of Bentia (Binting of Barth), called also even now Kotia-Kokia. The chief of this village is generally acknowledged to be a descendant of the Aksias, and in showing the ruins to the French officer he pointed out numerous Arabic inscriptions as the epitaphs of his ancestors, mentioning also various localities famous in the history of the Aksias as placed in the same neighbourhood. Apart from the tombstones, which still remain standing, the only trace of the old capital consists in shapeless mounds, strewn with fragments of pottery, etc. Lieut. Desplagnes points out the importance of the position of the old city, at the head of the navigable section of the middle Niger, at a point where the river, with its many islands surrounded by foaming rapids, afforded a fit cradle for the hardy founders of the Songhai empire.

The Fulani Emirates of Nigeria: Erratum.—An unfortunate printer's error has reversed the sense obviously intended by Major Burdon to be conveyed in an allusion, in his recent paper, to the native races of Northern Nigeria. On p. 637 of the December number, line 3, "applicable" should, of course, read "*in*applicable."

AMERICA.

Hanging Valleys in Central New York, and Supposed Glacial Erosion.—The position of those who decline to accept the supposed evidences of powerful erosion by ice is certainly not weakened as time goes on. Some weighty arguments against the glacial erosion theory have been put forward in the case of a special region in the United States—that of the Finger lake valleys of Central New York—by Prof. R. S. Tarr, in a paper printed in the *American Geologist* for May of last year, a reprint of which has lately reached us. Prof. Tarr's contribution to the discrediting of the theory is all the more noteworthy from the fact that in an earlier paper on the same region he had himself accepted glacial erosion as the agent to which the present deepened form of the valleys was due, but has been now led to the opposite conclusion by the irresistible logic of facts brought

to light by further study. The main morphological features of the neighbourhood of the Cayuga and Seneca lakes are as follows: The principal valleys form deep trenches (partly occupied by the lakes), while most of the side valleys that debouch into them are of an upland character, and have reached the stage of maturity. But on approaching the main valleys, the gradual slope of their floors comes to an end, and gives place to a steep gradient, while the streams have (since the glacial epoch) cut picturesque gorges through a zone of rock, which presents an otherwise uninterrupted fall to the main valley. The gorges occasionally widen out, owing to the presence of older buried gorges of pre-glacial age. These facts show that the upland valleys have their floors at a considerable elevation above the level of the lakes, and may be termed "hanging" valleys. Prof. Tarr gives many reasons for doubting the view that the main valleys have been "over-deepened" by ice, the principal being that the supposed ice-eroded valleys have the cross-section of gorges; that their sides show many angular precipitous cliffs below the hanging-valley level, with other features which should have been removed by the supposed ice-erosion; and that the observed facts limit such erosion in time to periods when its depth, and hence its effectiveness, would be diminished. Prof. Tarr shows that the existing facts can be well accounted for on the hypothesis of rejuvenation, due to an elevation and tilting of the main valleys.

The Louisiana Purchase.—In the case of a successful colonial venture, it is notable how soon the question of the "hinterland" becomes of capital importance, and how any attempt on the part of foreign powers to go behind its actual limits is acutely resented. The settlement is naturally founded at the coast, whence is communication with the motherland and the world at large. But the worth of the coastal settlement is the worth of the hinterland it taps, and the progress of the coastal settlement keeps pace with the recession of the inland boundary. In ancient times Massilia, and the neighbouring coastal colonies planted by it, implied a domain extending indefinitely backwards into Gaul and Spain. In our own days the whole history of the recent partition of Africa has been one of the acquisition of hinterlands. The hinterland, however, far and away the most magnificent and valuable known in history has been the prize of the American states. To make sure of the hinterland from the Alleghanies to the Mississippi, the colonials, fighting along with the home British, ejected the French (1755–62). But neither could the Mississippi be a definite boundary, but only a base for a further advance west. The United States, of the dimensions they have finally assumed, are due to the Louisiana Purchase, the centenary of which was celebrated last summer at St. Louis. The geography of this larger half is described from various points of view in *Journal of Geography*, Special No. (vol. 3, No. 6). The opening article, from the pen of Prof. Brigham, gives an instructive appreciation of the geographical importance of the purchase. Prof. Brigham shows by analogy that the central artery of the Mississippi could never have formed a boundary, as some have imagined, between two independent states, but was bound sooner or later to serve as a bond of union between the lands on either side. The purchase likewise gave the States the Pacific coast, and with it the gateways that lead out to Alaska, to Hawaii, to Manila, China, and Japan. As to whether the purchase was worth its price, only a figure or two can here be quoted. The wheat production of the Louisiana tract alone in 1900 was more than half that of all the United States. Its corn crop that year amounted to 48 per cent. of the total, the two grains within the area reaching a value of $464,000,000. This says nothing of oats, barley, rye, potatoes, hay, and cotton. In 1900 the purchase area raised more than one-third of the wool of the United States; add sugar and live-stock products, and the census shows that one per cent. of the farm produce for 1900 alone covered the whole

price paid to France for Louisiana. The subjects treated in the monograph include surface and climate, explorations, present industries, irrigation, geographical influences in the development of St. Louis, and several others.

POLAR REGIONS.

Observations on the East Coast of Greenland.—The expedition of Holm in 1883–85 made known the topography of the east coast of Greenland, from Cape Farewell to 66° N. lat., and the Ryder Expedition, 1891–92, explored the neighbourhood of Scoresby sound. With the view of joining up the work in these two regions, the Carlsberg Fund sent expeditions under Lieut. G. C. Amdrup, in 1898–99 and in 1900, to explore the intermediate coastal strip. The first expedition made its winter quarters at Tasiusak, in the Angsmagsalik district, and the records of the observations made, with analyses and discussions, have been published by the Danish Commission for the geographical and geological exploration of Greenland. The report deals first with determinations of position. Lieut. Amdrup fixes the observing station at Tasiusak, 65° 36′ 40″ N. lat. and 37° 33′ 26″ W. long. The second paper in the report, by Mr. V. Willaume-Jantzen, discusses the meteorological observations. These extend over the periods November 1, 1898, to February 22, 1899, and March 23 to May 16, 1899, and are of great value and interest, especially in relation to the passage of cyclones northwards between Greenland and Iceland, and to the *Foehn* phenomena of the region. Lieut. Ravn contributes a paper on observations of the aurora, and Mr. V. Hjort discusses those of terrestrial magnetism.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A Scheme for the Comparison of Climates.—Mr. W. F. Tyler, looking upon climate as the effect of meteorological conditions on human sensation, points out that of all the factors temperature and humidity are incomparably the most important. With a dry bulb at 77° Fahr. and a wet bulb at 76°, the climatic conditions, as far as Mr. Tyler's sensations are concerned, are similar to those experienced with a dry bulb at 90° and a wet bulb at 79°. He seeks for a measure of this joint temperature and humidity effect, which he terms "hyther," so as to be able to classify climates more precisely than by such terms as "bracing" and "relaxing." He would seek a sensation-scale for hyther similar to the Beaufort wind-scale. To obtain such a scale, he called the hottest, dampest, most enervating day in Shanghai 10; while zero was a brisk, warm, bracing day, one on which, when suitably dressed, no discomfort from temperature and humidity was felt. He induced twelve persons of regular habits to estimate their sensations by this scale every day at noon for a month, while meteorological records were taken by the Rev. Father Froc, S.J., the Director of Zikawei observatory. For summer, the results may be roughly expressed by the following equation:—

$$H = \frac{d - 1{\cdot}2(d - w) - 66}{3}$$

where H = hyther, d = dry-bulb reading, w = wet-bulb reading. The author points out that this is a preliminary result which must not be pushed too far. Probably the zero sensation could never be felt in a saturated atmosphere, and the isohyther lines for winter would have a different direction when plotted in a diagram from those for summer. The author hopes to interest others in hyther determinations, and considers that they would be of special use to the medical profession. There is no doubt that any reliable scale which would indicate the joint effect of temperature and humidity on human sensations and activities would be a great advance in applied climatology, especially in problems of colonization.—*Jour. Balneology and Climatology*, February, 1904.

GENERAL.

Honour to Captain Scott.—Captain Scott has received a gold medal from the Royal Danish Geographical Society, in recognition of his achievement as an Antarctic explorer. The medal bears an effigy of H.M. the King of Denmark.

Dr. J. J. Rein.—The well-known professor of geography at Bonn University, Dr. J. J. Rein, reached his seventieth birthday on January 27 of this year. In order to suitably commemorate Dr. Rein's services to geographical science, both as a traveller and teacher, a fund has been collected, and will be placed at the disposal of Bonn University, the proceeds to be devoted to the furtherance of scientific geography in the form of grants to young geographers to enable them to extend their knowledge by travel. The fund will be known as the "Justus Rein Stiftung." We cordially congratulate the distinguished geographer on this auspicious event.

Congress of French Geographical Societies.—The twenty-sixth session of the National Congress of French Geographical Societies will be held this year at St. Etienne, from the 6th to the 10th or 11th of August. We have received a circular in which a cordial welcome is offered to any members of our Society who may be able to be present. Visits to the principal industries of the region, and excursions, will be organized during and after the meeting. Those who wish to attend should notify their intention at an early date.

The Geographical Association.—The annual meeting of the Geographical Association was held in the Royal Colonial Institute, by permission of the Council, on January 6. The President, Mr. Douglas W. Freshfield, was in the chair. In his address the President called attention to the chief features of the Annual Report, viz. the very satisfactory growth of the Association, which had received 129 new members, and now numbered 448. The most important work carried out in 1904 was the exhibition of maps, models, slides, and other apparatus for teaching geography, which had been on view, not merely in London, but in some of the chief towns in England, Scotland, and Ireland. The association was much indebted to the local authorities, who had been responsible for local arrangements, and more particularly for the way in which they had organized special lectures on the teaching of geography, and given facilities for teachers and pupil-teachers to inspect the exhibits. Another point to which he alluded was the correspondence in the *Times* summarized in the January number of the *Journal*. He again pointed out that the chief barrier to progress in improved geographical teaching was the apathy or opposition of those controlling university and other examinations, and repeated that the first requisite to thinking imperially was to think geographically. Dr. C. R. Dryer, professor of geography in the Indiana State Normal School, then opened a discussion on Practical Geography. He outlined the gradual improvement which was taking place in the position and teaching of geography in America, and insisted on the importance which was now attached to practical work, by which he meant work done with things, not words. In his own classes, the practical work done consisted of the study of land forms, of the atmosphere and of such hydrography as could be carried out in an inland town. In studying land forms, it was necessary to have a small collection of common minerals and rocks, a large number of topographic maps, as many good models as possible (he had about twenty), and many views, both as photographic prints and lantern slides. Half the time nearly was spent on the study of topographic maps, which in the United States showed relief by means of contour-lines. The atmosphere was at all times available for instrumental and practical study. A child who could read a clock could learn to read a thermometer, and it was easy to teach a child to make simple meteorological observations. Each of his students had to keep a three months'

weather record and study the local conditions with reference to the maps and reports of the Weather Bureau, which *were supplied free to any public body agreeing to expose them in some public place.* The numerous lakes gave them examples of shore and wave phenomena, but they were naturally hampered in studying marine conditions 1000 miles from the sea. Field excursions he considered the most important of all. No doubt at first there was opposition, and great discouragement from the helplessness of the ordinary student, who at first could not see anything. That, however, was gradually overcome, and excursions made the geography teaching more vivid and more scientific. Many teachers took part in the discussion which followed. The difficulties of preparatory and public schoolmasters were outlined, and it was stated that until geography was adequately recognized by university and military authorities, it was impossible to secure sufficient time to teach the subject properly. The character more particularly of Government examinations for teachers was held to be responsible for the retention of bad methods. Various suggestions were made as to practical work which could be carried out in schools, such as methods whereby some conception might be given of the units used by geographers, the value of map-reading in the field, with a model and with views, various ways of modelling, exercises with the globe, observations of the sun and of meteorological conditions, the distribution of different kinds of trees, etc.

Practical Geography in Schools.—Those interested in the teaching of geography in schools will find an article in the January number of the *School World* well worthy of their careful consideration. It is the first of a series of articles giving suggestions for practical lessons entitled 'Experimental Geography,' by Mr. A. T. Simmons, B.SC., and Mr. Hugh Richardson, of Brootham School, York. Dealing with geography as any other branch of science, the authors propose to give suggestions for geographical experiments suitable for schools, which can be practically carried out by the pupils under the guidance of a teacher of the more enlightened type, of which the number is, happily, now gradually increasing. In all branches of science experiments are of the utmost importance, and more is often learnt by a few practical demonstrations than by any amount of verbal explanation. Why not adopt this method, wherever possible, in teaching geography? This is what Mr. Simmons and Mr. Richardson very properly recommend should be done; and in the series of articles which they hope to publish in the *School World*, outlines and suggestions for such practical lessons will be given, in the hope that others will adopt the plan and offer suggestions and improvements. The first lesson is entitled "Map-making," and deals with the first conception of maps and map-drawing by directing the pupil to construct a plan of his class-room. From this the area is increased, and he is called upon to make a plan of his school-house, with its surrounding grounds, using a magnetic compass, measuring tape, and sketching-board. A rough traverse is also outlined, and the plane-table is dealt with in an elementary way, and its use practically demonstrated by the pupil being instructed to make a plan of a cricket-field with it. The use of the protractor is described, and base-line measurement, the elements of triangulating with a theodolite, and levelling referred to. This is excellent in its way, and if not altogether original, it is the system of teaching which should be encouraged as much as possible. The difficulty that wil occur to some is the expense of the apparatus, but in reality this is not serious, with the exception of the theodolite, and this, the authors suggest, could be borrowed or hired from some instrument maker. In this there are obvious difficulties, which might, however, be got over, for the principle of the theodolite is so simple that an instrument quite sufficient for school demonstration purposes could be constructed for a very small sum. The system of teaching the pupil to begin with a plan of his immediate surroundings

and then gradually expanding his horizon, is good so far; but he should be taught to take a larger view of the Earth as well. Its position and relative size in the solar system, its actual dimensions and form, the forms and sizes of its great land-masses, are all amongst the subjects which lend themselves to practical demonstration. The globe deserves to occupy a far more conspicuous place in geographical education than it has hitherto done, and then it is quite easy to demonstrate the leading principles of map projection by simple models of the sphere and sections of it, combined with intersecting planes. Maps drawn upon the true curve of the Earth, such as Prof. E. Reclus has advocated so often lately, should also be in general use. Many other suggestions will occur to those desirous of adopting this method of geographical instruction, such as the practical construction by the pupils of clay models on large scales, to show the relief and leading physical features of a country and typical land formation, upon which contours should be drawn. It is to be hoped that the authors of these articles will see their suggestions gradually adopted, as they certainly deserve to be.

The Annual Report of the Russian Geographical Society.—The Annual Report of the Russian Geographical Society for 1903, which has only now reached us, is full, as usual, of interesting matter. A considerable amount of attention was given by the Society to the study of the lakes of the Russian Empire. L. S. Berg explored Lake Balkhash; V. S. Elpatievsky, Lake Kosogol, where he found that the temperature of the water is extremely low, even in summer, while its transparence is greater than in any of the hitherto explored sweet-water lakes; and finally, J. M. Shokalsky explored Lake Ladoga, where very low temperatures, below 4°, were found in the bottom layers. The explorations undertaken in the Tian Shan by V. I. Lipski, in order to complete his work on the flora of Central Asia, and in the range of Peter the Great by V. Th. Novitski, have already been mentioned in the *Journal*. In the same year, J. V. Voronoff explored some of the least known parts of the Sayan range in North-Western Mongolia, and B. B. Grinevetsky the flora of Transcaucasia, along the range which separates the provinces of Erivan and Elisabethpol. The distinctive feature of the vegetation in the mountains of Armenia is the nearly total absence of sub-alpine types and the abundance of xerophyte plants, which reach altitudes up to 10,000 feet and more. The slopes of the range are covered with clumps of the spiny species of *Astragalus* and *Acantholimon*. Only on the eastern slope are the xerophytes less developed, and oak forests are there found in the valleys. Interesting zoological explorations were made by V. A. Faussek in the Transcaspian region, and entomological studies in the Urals by V. E. Petersen. An interesting journey was also accomplished in the great tundra of Archangelsk by P. P. Mataftin; while several students, under the guidance of Prof. D. N. Anuchin, explored some lakes in European Russia and Transcaucasia. Of new expeditions we notice that of Dr. Zarudnyi and the botanist G. G. Gadd to Persia; that of W. L. Sieroszevski for the exploration of the Ainos in Japan; the expedition for recording the words and music of folk-songs in Central Russia having also continued its work. In addition to the three committees, for meteorological work, pendulum observations, and limnology, a new one was founded for the study of the hypsometrical data of the Russian Empire. The following awards of medals (among others) were made in January, 1904. The great Constantine medal was awarded to Friedrich Schmidt, member of the Academy of Sciences, the veteran explorer of both the vegetation and the geology of the Baltic provinces, as well as of Siberia, Sakhalin, and the Arctic tundras, whose work has been prosecuted without interruption for the last fifty years (an excellent sketch of this work, by Prof. Tchernysheff, is embodied in the report); the Count Lütke medal to Sir John Murray, for his well-known work in

oceanography, of which an excellent analysis is given by J. M. Shokalsky; and the Semenoff medal to Prof. N. I. Kuznetsoff, whose botanical exploration in the Caucasus and great work, 'Flora Caucasica Critica,' are epoch-making. The losses of the society during the year 1903 were very heavy. They included Dr. Gustav Radde, who has worked for the society since 1855, first in Eastern Siberia, and later on in the Caucasus; Robert E. Lenz, who did so much in organizing the meteorological polar stations, and wrote, in 1869, an important work on the Amu-daria question; Prof. Dokuchaeff, who started the immense work of studying the different soils of Russia, and has created a school of workers who will continue this useful survey; A. P. Engelhardt, the author of valuable works on the province of Archangel; R. N. Savelieff, a geodesist well known to the readers of the *Geographical Journal;* and Baza Menkedjieff, a Kalmuk, who in 1891 made a journey to Lhasa, and wrote a description, which was published by Prof. Pozdnéeff in both Kalmuk and Russian. The report contains also short reports of the different branches of the society, in all of which excellent geographical, limnological, ethnographical, etc., work was done. The discovery of a wide region of glaciers in the Trans-Ili Alatau, by S. Dmitrieff, will be probably the subject of further communications.

OBITUARY.

TWO ARCTIC VETERANS.

Sir Erasmus Ommanney and Sir James Donnet.

By Sir CLEMENTS R. MARKHAM, K.C.B.

Two Arctic veterans, Sir Erasmus Ommanney and Sir James Donnet, have passed away at a good old age. Both had reached their ninetieth year.

Born in May, 1814, young Ommanney entered the navy in August, 1826. He was a younger son of Sir Francis Ommanney, the navy agent, and nephew of Captain (afterwards Admiral Sir John) Ommanney, with whom he went to sea in H.M.S. *Albion*. While serving in that ship he was present at the battle of Navarino, in October, 1827, when only thirteen. He became a lieutenant in 1835, and joined the *Cove*, which ship Captain James C. Ross fitted out at Hull for the relief of some whalers caught in the ice. Crozier was the first lieutenant. It was a winter cruise, and there was much buffeting about in severe weather. Ommanney was next flag lieutenant, for three years, to his uncle at Lisbon and in the Mediterranean, and he was for a short time in the *Pique* under Captain Rous, one of the best schools for seamanship.

In 1840 Ommanney was promoted to the rank of commander, and he had the *Vesuvius* in the Mediterranean from 1841 to 1844. With him was an assistant surgeon, James John Louis Donnet, both to serve together in the Arctic Regions in the near future. Donnet was born at Malta, and received part of his education at Paris. He was an accomplished and most amiable officer, and a good French scholar. While in the *Vesuvius* Ommanney became the friend of Captain Horatio T. Austin, the future commander of the Arctic expedition, but then commanding the *Cyclops* in the Syrian war. In November, 1846, Ommanney was promoted to the rank of captain, and was employed by the Government during the Irish famine in carrying out the relief measures. Donnet, meanwhile, served for three years as surgeon of the *Calypso* in the Pacific, where I first made his acquaintance.

In 1845 Erasmus Ommanney became a Fellow of the Royal Geographical Society, and when he died he was second on the list in seniority.

When Captain Austin received the command of the Arctic expedition in 1850, for the search of Sir John Franklin, he selected Captain Ommanney, whom he had known intimately in the Mediterranean, as his second in command. Captain Austin had the *Resolute*, a sailing vessel of 410 tons, and Captain Ommanney the *Assistance*, of 430 tons. Each sailing vessel had a steam tender, the *Pioneer*, under Lieut. Sherard Osborn, for the *Resolute*, and the *Intrepid*, under Lieut. Cater, for the *Assistance*.

This expedition was remarkable for several reasons. It was practically the first expedition in which steam power was used for ice-navigation. It was the expedition which first organized an extensive system of sledge-travelling; while the internal arrangements of the ships were so excellent that perfect health was maintained.

In the *Assistance* Captain Ommanney had McClintock as his first lieutenant, who had already served for a year and a half in the Arctic Regions with Sir James Ross, Lieut^s. Elliott and Mecham, Vesey Hamilton, and myself. The surgeons were his old friend Dr. Donnet and Dr. Ede.

Leaving the Thames on May 4, 1850, the four vessels composing the expedition began their voyage to Greenland, and on May 23 Captain Ommanney opened convivial relations with the gun-room by sending us a chit inscribed "At home. Coffee and music at seven." He dined with us on Sundays, and showed a desire to make the ship comfortable from the first, which she certainly was.

After battling with the ice for forty days in Melville bay, the *Assistance* reached Cape York, and communicated with the Arctic Highlanders. Captain Ommanney took one of them on board, a lad of sixteen, who was named Erasmus York. Captain Ommanney afterwards had him educated at Canterbury, and looked after his interests until his melancholy death at St. John's, Newfoundland, in 1855.

On reaching the north water of Baffin's bay, Captain Austin parted company to visit the Eskimos at Pond's bay, while the *Assistance* and *Intrepid* proceeded up Lancaster sound ahead of all the other searching vessels. On Sunday, August 18, when 10 miles inside Cape Warrender, there was the appearance of a cairn on shore. Captain Ommanney went away in a boat, taking me with him, and we discovered a fine harbour. But it was coming on to blow, with a lowering sky, and we were scarcely on board again when half a gale of wind sprang up and sent the *Assistance* up Barrow's strait at the rate of 10 knots. Next day we were off Cape Riley. A cairn was observed on the shore, and a boat was at once sent to examine it. Several vestiges were found of a party belonging to Sir John Franklin's expedition, probably a shooting-party or naturalist's station near their winter quarters. We all thought that the neighbouring Beechey island ought to be searched, but Captain Ommanney, being well ahead of the other ships, and seeing open water, pushed onwards until he was closely beset in Wellington channel. Thus it was that the winter quarters of Sir John Franklin were discovered by the ships coming up behind us.

On September 6 the *Assistance* was very severely nipped near Cape Hotham, being lifted several feet out of the water by the tremendous pressure of the ice. For some hours the ship was in great danger. The other vessels overtook her, and eventually we had to winter in the pack between Griffith and Cornwallis islands. The winter arrangements were admirable, as they were sure to be with such a first lieutenant as McClintock. A newspaper, the *Aurora Borealis*, appeared monthly under the editorship of Dr. Donnet, to which the captain contributed the meteorological records, and there were theatricals, masked balls, and other amusements for officers and men, in which Captain Ommanney took his full share. No happier

nor more united ship ever wintered in the Arctic Regions, and for this result a share of the credit belongs to the captain.

The grand scheme of sledge-travelling, consisting of six extended parties, each with its limited depôt party, and each division with its auxiliary party, was the principal feature of this expedition. The work was organized by McClintock in every detail, in consultation with the captains and other officers. But McClintock deserves the whole credit. Captain Ommanney entered fully into the spirit of the work. He was anxious to do his part. There was no friction. McClintock's journey was by far the greatest that had ever been made in the Arctic Regions, and has never been surpassed except by himself in 1854. Captain Ommanney commanded what was called the Cape Walker division. He discovered the mass of land named after the Prince of Wales, and the great bay which bears his own name. William Dore, a splendid man, who had been with Sir John Richardson, was the captain of his sledge. The captain and his sledge crew were absent from the ship for sixty days, and went over 480 miles of ground. The name of the sledge was the "Reliance," bearing a red flag with a white Maltese cross, and the motto "*Domine dirige nos.*"

Returning to England, the old *Assistance* was paid off on October 10, 1851, after a memorable and exceptionally happy commission. Captain Ommanney contributed to this result, and there never was a truer friend nor a better messmate in every respect than Dr. Donnet. On January 7, 1852, I was the best man at my old messmate's wedding. The *Aurora Borealis* was published by Colburn in a white cover with a golden *Assistance* stamped on it. When I wrote a brief popular narrative of the expedition, entitled 'Franklin's Footsteps,' it was gratifying to me that my father received a cordial letter from Captain Ommanney expressing the satisfaction the little book had afforded him, and pronouncing it to be the most faithful and accurate narrative of the searching operations. "This interesting work," he adds, "must be productive of good feeling towards an expedition to which I trust that all who shared in its labours will look back with satisfaction."

Captain Ommanney's next employment was as senior officer in the White sea during the Russian war, in command of H.M.S. *Eurydice*, and afterwards of H.M.S. *Hawke* in the Baltic. His last employment afloat was the command of H.M.S *Brunswick* in the West Indies, relieving his old shipmate Captain Broadhead, with whom he had served in the *Pique*. Captain Ommanney paid the *Brunswick* off in 1860, and never went to sea again. He received the appointment of Captain Superintendent at Gibraltar.

On November 12, 1864, he obtained flag rank, was created a C.B. for his services in the Russian war, and was knighted for his Arctic service in 1876. He had been elected a Fellow of the Royal Society in 1868. Later in life he received the Grand Cross of the Order of Saviour of Greece for his very youthful services at Navarino. He was on the Council of the Royal Geographical Society from 1872 to 1875, and from 1879 to 1882; and he took a very active interest in the work of the United Service Institution, also serving on its council for many years. He was a Thames conservator. He strongly advocated the renewal of Antarctic exploration, serving on the committees of the British Association appointed with that object.

Sir Erasmus, it is to be feared, was a disappointed man. He never was allowed to hoist his flag, and he felt that his services had not been duly recognized. It was not until two years before his death that he received the Knight Commandership of the Bath. But he took great interest in all geographical work, and was a constant attendant at our meetings and at the British Association. He was President of Section E at Plymouth in 1877.

My old captain was a warm-hearted and sympathetic man, and always ready to help an old shipmate. In 1881 he was interesting himself in the welfare of the family of Mr. Dore, the gunner who had been his sledge captain; and I know that such acts of kindness on his part were frequent. Sir Erasmus died last December, after a long illness, at his son's house at Portsea, and was buried at Mortlake. He would have been ninety-one next May.

Dr. Donnet, after his return from the Arctic expedition, had a very distinguished career in the naval medical service. He was in charge of the naval hospitals at Lisbon, Jamaica, and Haslar, and afterwards enjoyed an honoured old age at his residences at Dover and Bognor. He was a director-general of hospitals and fleets, honorary physician to the King, and a Knight Commander of the Bath. He always kept up a correspondence with his Arctic messmates, and his beautiful handwriting is well known to us all. Sir James Donnet, himself slowly sinking from old age, sent his son-in-law to represent him at the funeral of his old friend and shipmate, Sir Erasmus Ommanney. He died last January.

The officers of the old *Assistance* were remarkable for their longevity. Last year six were alive out of eleven. Sir Erasmus Ommanney and Sir James Donnet reached their ninetieth years. Four still survive—Sir Leopold McClintock, Sir Vesey Hamilton, Dr. Ede, and myself. We number one Grand Cross and three Commanders of the Bath, three Fellows of the Royal Society, five of the Royal Geographical Society. The old *Assistance* was a happy and a distinguished ship.

Colonel C. E. Stewart, C.B., C.M.G., C.I.E.

The death occurred on December 26, 1904, of Colonel C. E. Stewart, an old and valued member of the R.G.S., on whose Council he had served in 1886–87. Colonel Stewart, who was born in 1836, was son of the late Mr. Algernon Stewart and grandson of the seventh Earl of Galloway. He entered the Indian army in 1854, and served with distinction during the Indian Mutiny, receiving a medal for his services. After serving in two other Indian campaigns, and reaching the rank of lieut.-colonel in 1879, he was employed on political service in Persia for some years, during which he was able to do some useful geographical work, the results of which were contributed from time to time to the *Proceedings* of the Society. In 1881 he read a paper on "The Country of the Tekke Turkomans," which appeared in the *Proceedings* for September of that year, accompanied by a map based largely on his own surveys. Some four years later he again read a paper, this time on his work on the Perso-Afghan frontier, where he had been employed by Government on special duty. One of his most interesting and hazardous journeys at this time was his crossing of the Lut, or desert of Eastern Persia, which had only once before been accomplished by a European since Marco Polo's time, and which he carried out at the most trying season of the year, suffering much from want of water during the passage. Having been made colonel in 1883 and C.B. in 1886, he became consul successively at Resht, Tabriz, and Odessa, finally retiring in 1899. Colonel Stewart was married in 1869, and leaves two sons, the elder being Captain A. B. A. Stewart, D.S.O., Seaforth Highlanders.

Edward John Payne.

It is with deep regret that we record the death, which occurred on December 26, 1904, from drowning in the canal at Wendover, of Mr. E. J. Payne, the well-known writer on historical and geographical subjects. Mr. Payne was the son of Mr. E.

W. Payne, of High Wycombe, and was born in 1844. He was educated at High Wycombe Grammar School, and at Oxford, where, after graduating with first-class honours in the Classical School in 1871, he was elected a Fellow of University College. In 1874 he was called to the Bar, and in 1883 became Recorder of High Wycombe. For a number of years he had devoted himself to the study of history, especially that of America, and of European colonization and discovery in general. The first volume of his important work on the 'History of the New World called America' was issued by the Clarendon Press in 1892, a second in 1899, and he continued up to his death the preparation of material for further volumes. To the 'Cambridge Modern History' he contributed two striking chapters on 'The Age of Discovery' and on 'The New World;' and among his other works were a 'History of European Colonies' (1877); two volumes of extracts from Hakluyt, relating to Elizabethan voyages to America; and a volume on 'Colonies and Colonial Federations' (only just completed before his death) in the English Citizen series. He was also engaged on other works, including an edition of 'Sir Francis Drake revived' for the Hakluyt Society, of whose council he was a valued member. Mr. Payne's loss will be keenly felt by all who knew him, to whom his genial and kindly disposition could not fail to endear him. He had joined our Society in 1886.

Captain Claud Alexander.

News, we regret to say, has been received from the Niger of the death from enteric fever, on November 30, of Captain Claud Alexander, who, in association with his brother, Lieut. Boyd Alexander, was doing such good work in the survey of some of the least-known parts of Northern Nigeria (see *ante*, p. 176, and vol. 24, p. 589). Captain Alexander was the youngest son of Lieut.-Colonel B. F. Alexander, of Cranbrook, Kent. Entering the army, he served with the Scots Guards throughout the South African war, being wounded at Belmont, and mentioned by Lord Methuen for gallant conduct in that engagement. He received two medals for his services in the war. Before setting out with his brother for Nigeria, he had taken much pains to qualify himself for survey work, and received the diploma of the Society after passing through a course of instruction. His labours during the present expedition had involved many difficulties and hardships, owing in part to the famine prevalent in various parts of the country; but he had shown great perseverance, and had already achieved valuable results. African geography has therefore suffered a severe loss by his untimely death at the early age of twenty-six years.

Charles H. Allen.

The veteran worker for the abolition of slavery, Mr. Charles H. Allen, died at Hampstead on December 19, 1904, at the advanced age of eighty years. Mr. Allen belonged to a Quaker family, well known for philanthropic sympathies, and in his early years travelled considerably in various parts of the world. In 1879 he became secretary of the British and Foreign Anti-slavery Society, a post which he held for nineteen years, throwing himself into the cause with immense energy and determination, and to his efforts was largely due the organization of the International Anti-slavery Conference, which met at Brussels in 1889. He had been a Fellow of our Society since 1864.

CORRESPONDENCE.

Philological Results of the British Occupation of the Island of Minorca.

INQUIRIES made during several visits I have paid to the Balearic islands have led to the discovery of the following philological results of the British occupation of Minorca.

As is well known, the island was occupied on three occasions by British troops. The first occupation lasted from 1712 until 1756; the second from 1763 until 1781; and the third and last from 1798 until 1802, when the island was finally restored to Spain, in accordance with the provisions of the Treaty of Amiens. Since that time there has been practically no communication with Great Britain, nor with any English-speaking country, other than that carried on by occasional visits of warships.

It is, therefore, interesting to find that, after the lapse of a century, the following English words are still in general use. I append them with the local orthography. Of course, the pronunciation has been considerably modified.

Stirrup, mug, shoemaker, chalk, boy, screw, rule, gin, midshipman, bottle, shake hands, haversack, razor, lath, clog, marbles, kettle, sideboard, plenty, lazy, beggar.

Recess means retirement or retreat.

Halloo, an exclamation used to make fun of any one.

Strop, the piece of leather or cloth used to keep the oar in the rowlock.

Stick, billiard cue.

Jack, jack-plane.

Play, the game of fives.

Stop, please, terms applied to the game of marbles.

Cap, night-cap.

Blackball, blacking for cleaning boots.

Black varnish, tar.

Set hammer, a kind of hammer used for polishing metal.

In. In playing marbles, when the marble goes into the hole, the player says, "In."

Out. When the marble goes out of the hole, the player says, "Out."

Pink, kiss, terms applied to the game of quoits.

Quick, term applied to the game of hide-and-seek.

Ox is the word used by farmers to call black cattle.

The most popular British governor was undoubtedly Sir Richard Kane, who died in the island in 1736. His memory was perpetuated by a small obelisk, now almost hidden by a causeway which has been built in recent years. This, and the barracks at San Felipe, are the only remaining monuments of the British occupation.

Numerous words with the affix *Kane* are still in general use, of which perhaps the most common is the fruit called *Peras de Kane.*

FREDERICK STERNBERG.

42, Calthorpe Road, Edgbaston, Birmingham.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904–1905.

Fourth Meeting, January 9, 1905.—Sir CLEMENTS MARKHAM, K.C.B., in the Chair.

ELECTIONS.—*James Brandis-Dunbar; Lieut. Virgoe Buckland, R.N.R.; Neville Baldwin Chichester; Ernest W. Dann, B.A.; Kenneth Douglas Field; Lieut. C.*

R. Bacon Habell, R.N.R. (Charting Officer, South Nigeria, W. Africa); Robert Hamer Hampson, LL.D., M.A.; J. L. Holland, B.A.; George Hopkins; Robert Collyer Jones; Maurice Simeon McKay, B.A.; J. F. Marshall; Penry Vaughan Morgan; Edward Gerald James Moyna; J. Owen-Jones; G. W. Palmer; Rt. Hon. Sir Joseph West Ridgeway, P.C., K.C.B., G.C.M.G., K.C.S.I.; Frank Rushby; Herbert Sharp; Jas. Hubert West Sheane, B.A.; Reginald John Smith, K.C.; Captain Hugh O. Swanston (3rd York and Lancaster Regiment); Rev. Frederick Herbert Taylor, B.A.; Reginald Charles Newton Twite.

The paper read was:—

"Mr. Reginald Enock's Journeys in Peru." By the President.

LECTURE TO YOUNG PEOPLE.

Friday, January 6, 1905, at 3.30 p.m.

"On the National Antarctic Expedition." By Captain R. F. Scott, C.V.O., R.N.

Fifth Meeting, January 23, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Captain C. R. H. Bacon (1st King's African Rifles); Frederick Hugh Capron; Captain Boyd Alexander Cuninghame (Hon. Captain 4th A. and S. Highlanders); Thomas Luther Evans; John Finch; David Peter de Villiers Graaff; Melville Hilton-Simpson; Captain Richard Percy Jones, R.F.A.; Ernest Romney Matthews, C.E., F.G.S., F.R.S.E.; Henry William Morrison; Rev. Theodore Tracey Norgate; Samuel Turner; Benjamin Whiteside.*

The Paper read was:—

"The Great Zimbabwe and other Ancient Ruins in Rhodesia." By Richard N. Hall, Esq.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. (Mém.) = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. (mét.) = Meteorological, etc.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Col. = Colonies.	R. = Royal.
Com. = Commerce.	Rev. (Riv.) = Review, Revue, Rivista.
C. R. = Comptes Rendus.	S. = Society, Société, Selskab.
E. = Erdkunde.	Sc. = Science(s).
G. = Geography, Géographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	Ts. = Tijdschrift, Tidskrift.
Is. = Izvestiya.	V. = Verein.
J. = Journal.	Verh. = Verhandlungen.
Jb. = Jahrbuch.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Hungary—Lakes. *Math. u. Naturw. Berichte Ungarn* 19 (1901): 51–54. **Kalecsinszky.**
Ueber die ungarischen warmen und heissen Kochsalzseen als natürliche Wärme-akkumulatoren, sowie über die Herstellung von warmen Salzseen und Wärme-akkumulatoren. Von A. v. Kalecsinszky.

Iceland. **Guðmundsson.**
Island am Beginn des 20. Jahrhunderts. Von V. Guðmundsson. Aus dem Dänischen von R. Palleske. Kattowitz in Schlesien: Gebrüder Böhm, 1904. Size 10 × 6½, pp. xvi. and 234. *Illustrations. Price* 6s.

An interesting sketch of Icelandic life and activities at the present day, with a chapter on the physical features of the country. Apart from this, the chapter which most concerns the geographer is that on the bases and conditions of practical life, which treats of trade, industries, communications, etc.

Italy—Strait of Messina. **Platania.**
G. Platania. I cavi telegrafici e le correnti sottomarine nello Stretto di Messina. (Rivista Marittima, estratto dai fasc. di agosto-sett. 1904.) Città di Castello, 1904. Size 9 × 6½, pp. 36. *Presented by the Author.*

Spain—Pyrenees. *Rev. G.* 28 (1904): 270–278. **Briet.**
La garganta d'Escoain. Par L. Briet. *With Map and Illustrations.*

Sweden—Lakes. **Grenander.**
Les variations annuelles de la température dans les lacs suèdois. Par S. Grenander. (Reprinted from Bull. of the Geol. Instit. of Uppsala, vol. vi. part i.) Uppsala, 1904. Size 10 × 6½, pp. 160–168. *Diagrams.*

Turkey—Albania. *Deutsch. Rundschau G.* 26 (1904): 558–562. **[Steinmetz.]**
Durch de Hochländergaue Oberalbaniens. *With Map and Illustrations.*

Résumé of a brochure by Herr Steinmetz.

United Kingdom—England and Wales. **De Salis.**
Bradshaw's Canals and Navigable Rivers of England and Wales. A Handbook of Inland Navigation for Manufacturers, Merchants, Traders, and others. Compiled, after a Personal Survey of the whole of the Waterways, by H. R. De Salis. London: H. Blacklock & Co., 1904. Size 10 × 6½, pp. 480. *Map. Price* 21*s. Presented by the Publishers.*

This supplies for the first time a comprehensive handbook to the inland navigation of England and Wales, which will be indispensable to all students of the subject. It gives full statistics, and the information has been checked by a personal survey of the waterways, which are clearly shown in blue on the accompanying map.

United Kingdom—Geological Survey. ——
Memoirs of the Geological Survey. Summary of Progress of the Geological Survey of the United Kingdom and Museum of Practical Geology for 1903. London: E. Stanford, 1904. Size 10 × 6½, pp. 196. *Maps and Sections. Price* 1*s. Presented by the Geological Survey.*

United Kingdom—Hertfordshire. **Skeat.**
The Place-Names of Hertfordshire. By the Rev. Prof. Skeat. Hertford. Printed for the East Herts Archæological Society, 1904. Size 9 × 6, pp. 76. *Price* 3*s.* 6*d.*

Prof. Skeat here extends to Hertfordshire his valuable studies of place-names on a philological basis, of which a previous outcome was a similar volume on the Cambridgeshire names (1900).

United Kingdom—Ireland—Historical. **Falkiner.**
Illustrations of Irish History and Topography, mainly of the Seventeenth Century. By C. L. Falkiner. London: Longmans & Co., 1904. Size 9 × 6, pp. xx. and 434. *Map and Plans. Price* 18*s. net. Presented by the Publishers.*

The chapter with most bearing on geography is that on the counties of Ireland, their origin, constitution, and gradual delimitation, which had already been printed elsewhere, and noticed in the *Journal* (vol. 23, p. 781). Other sections deserving notice are, that on the woods of Ireland, and the reprints of contemporary accounts of Ireland in the seventeenth century, which are of interest as throwing light on the changes which have since taken place. They include the Irish section of Fynes Moryson's 'Itinerary,' and some others less generally accessible, such as the travels of Sir W. Brereton (1635), and M. Jouvin or Jorevin's description of 1672.

United Kingdom—London. **Baedeker.**
London and its Environs. Handbook for Travellers by Karl Baedeker. Fourteenth

edition. Leipzig: K. Baedeker; London: Dulau & Co. 1905. Size 6¼ × 4¼, pp. x., 472, and 44. *Maps and Plans. Price 6m. Presented by Messrs. Dulau & Co.*

The information in this edition is brought down to October, 1904.

United Kingdom—Scotland. **Rickmers.**

Aquatic Sport on Ben Nevis. By W. R. Rickmers. (Reprinted from the *Scottish Mountaineering Club Journal.*) Size 8¼ × 5¼, pp. 10. *Illustrations. Presented by the Author.*

An account of skiing experiences in Scotland. The writer points out that local forms of ski have been in use in the British Isles for generations.

United Kingdom—Yorkshire. *Geolog. Mag.* 1 (1904): 544–551. **Carter.**

River Capture in the Don System. By the Rev. W. L. Carter.

The Glaciation of the Don and Dearne Valleys. By the same.

ASIA.

Central Asia—Tian Shan. *Petermanns M.* 50 (1904): 272–273. **Friederichsen.**

Peneplain-Bildungen im zentralen Tiën-schan? Von Dr. M. Friederichsen.

Central Asia—Tian Shan. **Merzbacher.**

Petermanns M. Ergänzungsheft No. 149 (1904): pp. 100.

Vorläufiger Bericht über eine in den Jahren 1902 und 1903 ausgeführte Forschungsreise in den zentralen Tian-Schan. Von Dr. G. Merzbacher. *With Map and Panoramas.*

Chinese Empire—Tibet. *J.G. Tōkyō G.S.* 16 (1904): 193-194. **Ogawa.**

Yasuteru Narita's Travel to Lhassa. By T. Ogawa. [In Japanese.]

Chinese Empire—Tibet. **Sandberg.**

The Exploration of Tibet: its History and Particulars from 1623 to 1904. By G. Sandberg. Calcutta: Thacker, Spink & Co.; London: W. Thacker & Co. 1904. Size 9 × 5½, pp. vi. and 324. *Map and Plan. Presented by the Author.*

A useful and carefully carried out compilation. The map is somewhat roughly drawn, and shows only the main outlines of Tibetan geography.

French Indo-China—Tongking. *B.G. Hist. et Descriptive* (1903): 421–497. **Girard.**

Les tribus sauvages du Haut-Tonkin. Mans et Méos, notes anthropométriques et ethnographiques. Par Dr. H. Girard. *With Map and Plates.*

India—Population. *Quarterly J.R. Meteorolog. S.* 30 (1904): 273–285. **Dallas.**

The Variation of the Population of India compared with the Variation of Rainfall in the decennium 1891-1901. By W. L. Dallas. *With Maps.*

Japan. *P.R. Philosoph. S. Glasgow* 35 (1903–1904): 289-300. **Fukuzawa.**

The Future of Japan from the Geographical Point of View. By Sampachi Fukuzawa.

Japan. *J.G., Tōkyō G.S.* 15 (1903): 631–636; 16 (1904): 28-31. **Tanaka.**

Limnological Researches in Environs of the Bandai-san. By A. Tanaka. [In Japanese.]

Japan—Trade. **Hatton.**

The Foreign Commerce of Japan since the Restoration, 1869–1900. By Y. Hatton. (Johns Hopkins University Studies, Series xxii. Nos. 9–10.) Baltimore, 1904. Size 9½ × 6, pp. 80. *Diagrams.*

Japan—Volcanoes. *J.G., Tōkyō G.S.* 15 (1903): 813–818. **Otsuki.**

Volcanoes of North Japan. By Yōnosuke Ōtsuki. [In Japanese.]

Malay Archipelago—Borneo. **Beccari.**

Wanderings in the Great Forests of Borneo. Travels and Researches of a Naturalist in Sarawak. By O. Beccari. Translated by Dr. E. H. Giglioli, and revised and edited by Dr. F. H. H. Guillemard. London: A. Constable & Co., 1904. Size 9 × 6, pp. xxiv. and 424. *Maps and Illustrations. Price 16s. net. Presented by the Publishers.*

The Italian original was reviewed in the *Journal* for October, 1902 (vol. 20, p. 443).

Persia. **De Morgan and Huart.**

Mission Scientifique en Perse. Par J. de Morgan. Tome v. Études linguistiques. Deuxième Partie. Textes Mandaïtes publiés par J. de Morgan. Avec une

Notice sur les Mandéens. Par C. Huart. Paris: E. Leroux, 1904. Size 11½ × 9, pp. xiv. and 286. *Plates. Price 40 fr.*

South-East Asia. **Heger.**

Alte Metalltrommeln aus Südost-Asien. Mit Unterstützung der Gesellschaft zur Förderung Deutscher Wissenschaft, Kunst und Literatur in Böhmen, herausgegeben von Franz Heger. Text and Plates. Leipzig: K. W. Hiersemann, 1902. Size 15 × 11½, pp. 248. *Presented by the Author.*

Turkey—Asia Minor. *Globus* 86 (1904): 129–133. **Janke.**

Das Schlachtfeld am Granikus. Von Oberst A. Janke. *With Map and Illustrations.*

AFRICA.

Africa—Historical. **Vollkommer.**

Die Quellen Bourguignon d'Anvilles für seine Kritische Karte von Africa. Von Dr. M. Vollkommer. (Münchener Geographische Studien, herausgegeben von S. Günther. Sechzehntes Stück.) München: T. Ackermann, 1904. Size 9½ × 6, pp. 124. *Price 2s. 6d.*

This will be specially noticed.

Angola. *Z. Kolonialpolitik* 6 (1904): 743–748. **Singelmann.**

Von Mossamedes zum Kunene. Von C. Singelmann.

Central Africa. **Pierre.**

De Brazzaville au Caire par l'Oubangui et le Bahr-el-Ghazal (1903–1904). Par C. Pierre. (Extrait du *Bulletin de la Société de Géographie Commerciale*, No. 3, Année 1904.) Paris, 1904. Size 9 × 5½, pp. 24. *Map. Presented by the Author.*

Central Sudan. *C. Rd.* 139 (1904): 378–379. **Hubert.**

Sur les roches éruptives rapportées par la mission Niger-Bénoué-Tchad. Note de H. Hubert.

Congo State. **Fuchs.**

Congo Free State. Report of the Vice-Governor General to the Secretary of State. (Extract from *Bulletin Officiel*, No. 7, July, 1904.) Brussels: J. Lebègue & Co. Size 9 × 6, pp. 96.

Dahome. *La G., B.S.G. Paris* 10 (1904): 267–286. **Drot.**

Notes sur le haut Dahomey. Par — Drot. *With Maps.*

Dahome—Borgu. *La G., B.S.G. Paris* 10 (1904): 145–160. **Brousseau.**

Le Borgou. Par G. Brousseau. *With Map.*

East Africa. *Jahresb. G.-Ethnog. Ges. Zürich* (1903–1904): 39–67. **Kollbrunner.**

Die Eisenbahn von Djibouti nach Harar. Von U. Kollbrunner. *With Map and Illustrations.*

Egypt. **Wessely.**

Topographie des Faijûm (Arsinoites Nomus) in griechischer Zeit. Von Dr. K. Wessely. (Denkschriften der K. Akademie der Wissenschaften in Wien. Philosophisch-historische Klasse. Band L. i.) Wien: C. Gerold's Sohn, 1904. Size 12½ × 10, pp. 182. *Maps. Price 11s.*

Egypt—Agriculture. *Scottish G. Mag.* 20 (1904): 561–568. **Joannides.**

Egyptian Agriculture, with special reference to Irrigation. By P. N. Joannides.

Egyptian Sudan. *J. Anthrop. I.* 34 (1904): 149–166. **Cummins.**

Sub-tribes of the Bahr-el-Ghazal Dinkas. By Captain S. L. Cummins. *With Illustrations.*

German South-West Africa. *G.Z.* 10 (1904): 507–513. **Dove.**

Die geographische Eigenart des Aufstandsgebietes in Südwest-Afrika. Von K. Dove.

Kamerun. *Deutsch. Kolonialblatt* 15 (1904): 587–591, 610–613. **Hirtler.**

Bericht des Oberleutnants Hirtler über eine Erkundungsexpedition von Bamum nach Jabassi.

Kamerun. *Z. Kolonialpolitik* 6 (1904): 539–552. **Kürchhoff.**

Binnenwasserstrassen in Kamerun. Von D. Kürchhoff.

Kamerun. **Puttkamer.**
Deutsch. Kolonialblatt 15 (1904): 80–82, 121–123, 186–188, 321–323.
Bericht des Kaiserlichen Gouverneurs v. Puttkamer über seine Reise in das Tschadseegebiet.

Lake Chad. *Z. Kolonialpolitik* 6 (1904): 522–538. **Kannengiesser.**
Der Tsâde oder Tsâdsee. Von G. A. Kannengiesser.

Madagascar. *J. Asiatique* 3 (1904): 489–509. **Ferrand.**
Madagascar et les îles Uâq-Uâq. Par G. Ferrand.
The writer derives the Wak-wak of the old Arab writers from one or other of two Malagasy words (see *ante*, p. 98).

Morocco. *B.S.G. Cher* 2 (1903–1904): 247–253. **Attanoux.**
Le Maroc, Politique, Économique et Pittoresque par le Comte J. B. d'Attanoux. (Compte rendu par J. Machat.) *With Map and Illustrations.*

Morocco. *Questions Dipl. et Colon.* 18 (1904): 465–473. **Franklin.**
L'accord franco-espagnol au sujet du Maroc. Par J. H. Franklin.

Sahara. *B.G. Hist. et Descriptive* (1903): 498–526. **Flamand.**
Note sur les inscriptions et dessins rupestres de la Gara des Chorfa du district de l'Aoulef (Tidikelt; Archipel Touatien) recueillies par M. le Commandant Deleuze (1901–1902). Par G. B. M. Flamand. *With Illustrations.*

Sahara. *La G., B.S.G. Paris* 10 (1904): 81–84. **Villatte.**
Le raid du Commandant Laperrine à travers le Sahara. Lettre de M. Villatte. *With Map.*
See note in the *Journal* for October last (p. 481).

Sierra Leone. *J. Manchester G.S.* 19 (1903): 155–166. **Smith.**
Some account of the Colony and Hinterland of Sierra Leone. By the Rev. Canon F. C. Smith. *With Illustrations.*

Swaziland. *B.S.G. Lisboa* 22 (1904): 222–241, 265–282. **Lima.**
O caminho de ferro da Swazilandia. Por A. A. Lisboa de Lima. *With Map.*

Togo. *Globus* 86 (1904): 283–286. ——
Die Festlegung der Westgrenze von Togo. *With Map.*

Transvaal. ——
Geological Survey of the Transvaal. Report for the year 1903. Pretoria, 1904. Size 13½ × 8½, pp. 48. *Maps and Illustrations. Presented by the Geological Survey of the Transvaal.*

Tripoli. *B.S.G. Com. Havre* 21 (1904): 13–35. **Mathuisieulx.**
Voyage en Tripolitaine en 1903. Par le Vicomte de Mathuisieulx.
This journey was briefly described in the *Journal* for December, 1903 (p. 700).

Tripoli. *B.S.G. Lille* 42 (1904): 79–101. **Mathuisieulx.**
Voyage en Tripolitaine. Par M. le Vicomte de Mathuisieulx.

Tropical Africa—Meteorology. ——
Meteorological Office. Climatological Observations at Colonial and Foreign Stations. I.—Tropical Africa, 1900–1901–1902. Tables prepared by E. G. Ravenstein. London: Eyre & Spottiswoode, 1904. Size 12½ × 10, pp. 54. *Map. Price 6s. Presented by the Meteorological Office.*
Students of African climatology will be glad to know that the publication of results of observations in Tropical Africa, inaugurated by the British Association Committee of which Mr. Ravenstein was chairman, is being continued under the Meteorological Office.

Tunis. *B.G. Hist. et Descriptive* (1904): 33–68. **Hamy.**
Cités et nécropoles berbères de l'Enfida (Tunisie moyenne). Étude ethnographique et archéologique. Par E. T. Hamy. *With Maps and Illustrations.*

NORTH AMERICA.

Alaska—Telegraph System. *National G. Mag.* 15 (1904): 357–361. **Mitchell.**
Building the Alaskan Telegraph System. By Captain W. Mitchell.

Canada. **Tyrrell and Dowling.**
Ann. Rep. Geol. Surv. Canada 13, 1900 (1903): Reports F and FF, pp. 48, 44.
On the north-eastern portion of the District of Saskatchewan and adjacent parts of the districts of Athabasca and Keewatin. By J. B. Tyrrell. *Plate.*
On Geological Explorations in Athabasca, Saskatchewan, and Keewatin districts. By D. B. Dowling. *Map and Plate.*

Canada—British Columbia. **Morice.**
Du lac Stuart à l'Océan Pacifique. Par le R. P. A.-G. Morice. (Extrait du *Bulletin de la Société Neuchâteloise de Géographie*, tome xv., 1904.) Neutchatel: Imp. P. Attinger, 1904. Size 9½ × 6½, pp. 52. *Map and Illustrations. Presented by the Author.*

Mexico. **Farrington.**
Observations on the Geology and Geography of Western Mexico, including an account of the Cerro Mercado. By O. C. Farrington, PH.D. (Field Columbian Museum, Publication No. 89, Geological Series, vol. ii. No. 5.) Chicago, 1904. Size 10 × 6½, pp. 197–228. *Map and Illustrations. Presented by the Field Columbian Museum.*

Noticed in the Monthly Record for January (p. 95).

Mexico—Mitla. *J.R.I. Brit. Architects* 11 (1904): 513–526. **Johnson.**
The Ruins of Mitla, Mexico. By C. G. Johnson. *With Plans and Illustrations.*

North America—Ice. *J. Geology* 12 (1904): 232–236. **Tyrrell.**
Crystosphenes or Buried Sheets of Ice in the Tundra of Northern America. By J. B. Tyrrell. *With Illustration.*

Noticed in the *Journal* for November (p. 951).

United States. **Fuller.**
U.S. Geolog. Surv., Water-Supply and Irrigation Paper, No. 102 (1904): pp. 522.
Contributions to the Hydrology of Eastern United States, 1903. M. L. Fuller.

United States—Boundaries. *B.U.S. Geolog. Surv.*, No. 226 (1904): pp. 146. **Gannett.**
Boundaries of the United States and of the Several States and Territories, with an outline of the History of all important changes of territory (third edition). By H. Gannett. *With Maps.*

United States—Delaware. *B.U.S. Geolog. Surv.*, No. 230 (1904): pp. 16. **Gannett.**
A Gazetteer of Delaware. By H. Gannett.

United States—Geological Survey. **Walcott.**
Twenty-fourth Annual Report of the Director of the United States Geological Survey to the Secretary of the Interior 1902–3. Washington, 1903. Size 11½ × 8, pp. 302. *Maps. Presented by the U.S. Geological Survey.*

Includes a summary of geographical work in Alaska.

United States—Hydrology. **Newell.**
U.S. Geolog. Surv., Water-Supply and Irrigation Paper, No. 93 (1904): pp. 362.
Proceedings of First Conference of Engineers of the Reclamation Service. With accompanying papers, compiled by F. H. Newell. *With Diagram.*

Among the papers printed is one by I. W. McConnell on the grand cañon of the Gunnison.

United States—Louisiana. **Harris and Fuller.**
U.S. Geolog. Surv., Water-Supply and Irrigation Paper, No. 101 (1904): pp. 98.
Underground Waters of Southern Louisiana, by G. D. Harris. With discussions of their uses for water-supplies and for rice irrigation, by M. L. Fuller. *With Maps and Illustrations.*

United States—Maryland. *B.U.S. Geolog. Surv.*, No. 231 (1904): pp. 84. **Gannett.**
A Gazetteer of Maryland. By H. Gannett.

United States—Massachusetts. *J. Geology* 12 (1904): 198–214. **Clapp.**
Relations of Gravel Deposits in the Northern part of glacial Lake Charles, Massachusetts. By F. G. Clapp. *With Maps.*

United States—Massachusetts. *J. Geology* 12 (1904): 181–197. **Fuller.**
Ice-retreat in glacial Lake Neponset and in South-eastern Massachusetts. By M. L. Fuller. *With Map and Sections.*

United States—Virginia. *B.U.S. Geolog. Surv.*, No. 232 (1904): pp. 160. **Gannett.**
A Gazetteer of Virginia. By H. Gannett.

United States—West Virginia. *B.U.S. Geolog. Surv.*, No. 233 (1904): pp. 164. **Gannett.**
A Gazetteer of West Virginia. By H. Gannett.
The above belongs to a series of excellent gazetteers of the separate states of the American Union, all prepared by Mr. H. Gannett.

CENTRAL AND SOUTH AMERICA.

Argentine Republic—Mines. **Hoskold.**
Official Report upon the Mines, Mining, Metallurgy and Mining Laws, etc., etc., of the Argentine Republic. By H. D. Hoskold. Buenos Aires: South American Bank Note Company, 1904. Size 10½ × 7, pp. iv. and 474.

Bolivia and Brazil. *B. Oficina Nac. La Paz* 3 (1903): 626–636. ———
Tratado de limites entre Bolivia y el Brasil.

Bolivia—Oruro. **Blanco.**
Diccionario Geográfico de la Republica de Bolivia. Tomo Cuarto. Departamento de Oruro. Por P. A. Blanco. La Paz: 1904. Size 10½ × 7½, pp. 98 and cxvi. *Plan.*

Brazil. *Petermanns M.* 50 (1904): 260–266. **Ihering.**
Der Rio Juruá. Von Dr. H. v. Ihering.

Brazil. *Kolon. Z.* 5 (1904): 332–333, 351–353, 371–372. **Papstein.**
Kolonisation in den Missionen am Alto Uruguay, Südbrasilien. Von A. Papstein.

Brazil. *Rev. Centro Sci., etc., Campinas* 3 (1904): 90–95. **Krone.**
Grutas Calcareas do Valle da Ribeira. R. Krone. *With Illustrations.*

Brazil—Ethnology. *Globus* 86 (1904): 119–125. **Schmidt.**
Aus den Ergebnissen meiner Expedition in das Schingúquellgebiet. Von Dr. M. Schmidt. *With Illustrations.*

Brazil and British Guiana. ———
Monthly B. Internat. Bureau American Reps. 17 (1904): 620–623.
Boundary Award between Brazil and British Guiana.

Central America and West Indies. **Elliot.**
The Land and Sea Mammals of Middle America and the West Indies. By D. G. Elliot. (Field Columbian Museum, Publication 95, Zoological Series, vol. iv. parts i. and ii.) Chicago, 1904. Size 10 × 6½, pp. xx. and 850. *Illustrations. Presented by the Field Columbian Museum.*

Panama Canal. *Deutsch. G. Blätter* 27 (1904): 83–94. **Kürchhoff.**
Die Bedeutung des Panamakanals. Von D. Kürchhoff.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. *Scottish G. Mag.* 20 (1904): 577–584. **Macdonald.**
Some features of the Australian interior. By R. M. Macdonald. *With Illustration.*

Australia Alps. *Petermanns M.* 50 (1904): 235–243. **Lendenfeld.**
Die einstige Vergletscherung der Australischen Alpen. Von Prof. Dr. R. v. Lendenfeld. *With Illustrations.*

Marianne Islands. *Globus* 86 (1904): 278–282. **Seidel.**
Saipan, die Hauptinsel der deutschen Marianen. Von H. Seidel.

Marianne Islands. *G. Anzeiger* 5 (1904): 217–220. **Seidel.**
Der geologische Aufbau der deutschen Marianen-Insel Saipan. Von H. Seidel.

New Guinea. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 21 (1904): 879–890. **Ijzerman.**
De Nieuw-Guinea-Expeditie van het Koninklijk Nederlandsch Aardrijkskundig Genootshap. Door J. W. Ijzerman.
See note in the January number (p. 97).

New Guinea. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 21 (1904): 998–1021. **Oosterzee.**
Eene verkenning in het binnenland van Noord-Nieuw-Guinea. Door L. A. van Oosterzee. *With Maps.*

Victoria. *P.R.S. Victoria* 17 (1904): 120–144. **Gregory.**
The Antiquity of Man in Victoria. By Dr. J. W. Gregory, F.R.S.

POLAR REGIONS.

Antarctic. *B.I.G. Argentino* **22** (1904): 144–160. **Delachaux.**
Antártida. E. A. S. Delachaux. *With Map.*
Discusses the geographical problems offered by the Antarctic.

Antarctic. **Pariset.**
Vers la terre polaire Australe. Par E. Pariset. (Extrait des *Mémoires de l'Académie des Sciences, Belles-Lettres et Arts de Lyon.*) Lyon: A. Rey, 1904. Size 11 × 7, pp. 134. *Maps. Presented by the Author.*
An historical sketch of efforts for the discovery of the southern regions.

Antarctic—Argentine Expedition. *B.I.G. Argentino* **22** (1904): 57–82. **Irizar.**
Partes oficiales del viaje de "La Uruguay." J. Irizar.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Cartography. *Deutsch. G. Blätter* **27** (1904): 95–116. **Wolkenhauer.**
Aus der Geschichte der Kartographie. Von W. Wolkenhauer.
A useful list of famous maps from the revival of interest in Ptolemy's geography in the last quarter of the fifteenth century to Mercator's time. Brief notes are given on special points for which the maps are noteworthy. The list is, however, by no means complete; thus we miss, among others, the various Desceliers maps of the second quarter of the sixteenth century, the Maiollo map of 1527, and the globe of Robert de Bailly of 1530.

Cartography. *Nature* **71** (1904): 159–161. **Beazley.**
The First True Maps. By C. R. Beazley.
An account of the early Portolani of the fourteenth century.

Cartography. **Hantzsch.**
Die Landkartenbestände der Königlichen öffentlichen Bibliothek zu Dresden. Nebst Bemerkungen über Einrichtung und Verwaltung von Kartensammlungen von V. Hantzsch. (Beihefte zum Zentralblatt für Bibliothekswesen, xxviii.) Leipzig: O. Harrassowitz, 1904. Size 9½ × 6½, pp. vi. and 146. *Price* 6*s*.
This will be noticed elsewhere.

Cartography—Reliefs. *B.S.G. Genève* **43** (1904): 103–110. **Perron.**
Reliefs à grande échelle. Par C. Perron.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Cosmography. *Math. u. Naturw. Berichte Ungarn* **19** (1901): 204–223. **Kövesligethy.**
Ueber die Entwickelung der Himmelskörper und das Alter der Erde. Von R. v. Kövesligethy.

Geophysics. **Omori.**
Note on the Relation between Earthquakes and Changes in Latitude. By F. Omori. (Publications Earthquake Investigation Committee in Foreign Languages. No. 18. Pp. 13–21.) Tōkyō, 1904. Size 10½ × 7½. *Diagrams.*

Glacial Epoch. **Pilgrim.**
Versuch einer rechnerischen Behandlung des Eiszeitproblems. Von Prof. Dr. L. Pilgrim. (Separat-Abdruck aus 'Jahreshefte des Vereins für Vaterl. Naturkunde in Württemberg,' Jahr. 1904, Bd. 60.) Stuttgart, 1904. Size 9 × 6, pp. 26–117. *Diagram. Price* 4*s*.
An attempt to elucidate the glacial problem by calculation from astronomical data.

Glaciers—Moraines. *Rev. G. Italiana* **11** (1904): 399–411. **Dainelli.**
Intorno alla nomenclatura delle morene secondo recenti studii. G. Dainelli.

Hydrography—Tables. **Knudsen.**
Conseil Perm. Internat. Explor. Mer, Publ. Circonstance, No. 11 (1904): pp. 24.
σ_t Tabelle. Anhang zu den 1901 herausgegeben hydrographischen Tabellen. Von M. Knudsen.

Limnology—Fauna. *Math. u. Naturw. Berichte Ungarn* **19** (1901): 89–124. **Entz.**
Die Fauna der Kontinentalen Kochsalzwässer. Von Dr. G. Entz.

Meteorology—Rain. *Symons's Meteorolog. Mag.* 39 (1904): 161–165. **Mill.**
On the Unsymmetrical Distribution of Rainfall about the Path of a Barometric Depression. By Dr. H. R. Mill. *With Diagrams.*

Meteorology—South Atlantic. **Hepworth.**
Symons's Meteorolog. Mag. 39 (1904): 170–171.
The Relation between Pressure, Temperature, and Air Circulation over the South Atlantic Ocean. By Commander C. Hepworth, C.B.

Meteorology—Whirlwinds. *Mém. S.G. Genève* 43 (1904): 95–134. **Brunhes.**
Nouvelles observations sur le rôle et l'action des Tourbillons. Par J. Brunhes. Avec deux appendices par S. Squinabol et G. Dal Piaz. *With Plates.*

Oceanography. *C. Rd.* 139 (1904): 631–632. **Thoulet.**
Fonds marins de l'Atlantique nord, bancs Henderson et Chaucer. Note de M. Thoulet.

Oceanography. *Naturw. Wochenschrift* 3 (1904): 721–726. **Walther.**
Ueber Entstehung und Besiedelung der Tiefseebecken. Von Prof. D. J. Walther.

Oceanography. *Z. Ges. Erdk. Berlin* (1904): 484–497. **Hjort.**
Forschungsfahrten auf nordischen Meeren. Von J. Hjort.

Oceanography—Atlantic. *Ann. Hydrographie* 32 (1904): 353–362. **Meinardus.**
Ueber Schwankungen der nordatlantischen Zirkulation und ihre Folgen. Von Dr. W. Meinardus. *With Diagram. Also separate copy, presented by the Author.*

Oceanography—Guinea Current. ———
K. Nederlandsch Meteorologisch Instituut. No. 95. Observations Océanographiques et Météorologiques dans la Région du Courant de Guinée (1855–1900). I. Texte et Tableaux. II. Planches. Utrecht: Kemink & Zoon, 1904. Size 13 × 10, (Plates) 23 × 18½; pp. vi. and 116. *Presented by the K. Ned. Meteorolog. Instituut.*

Seismology. **Sieberg.**
Handbuch der Erdbebenkunde. Von A. Sieberg. Braunschweig: F. Vieweg und Sohn, 1904. Size 9 × 6, pp. xviii. and 362. *Maps and Illustrations.* [To be reviewed.]

Terrestrial Magnetism. *Deutsch. G. Blätter* 27 (1904): 63–82. **Schütz.**
Die magnetischen Pole der Erde. Von Dr. E. H. Schütz.

Zoogeography—Whales. **True.**
Smithsonian Contributions Knowledge 33 (1904): pp. 332.
The Walebone Whales of the Western North Atlantic, compared with those occurring in European Waters; with some Observations on the Species of the North Pacific. By F. W. True. *With Plates.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Colonisation—Methods. *Z. Kolonialpolitik* 6 (1904): 684–713. **Pauli.**
Der Kolonist der Tropen als Häuser-, Wege- und Brückenbauer. Von C. Pauli. *With Illustrations.*

Commercial Geography. **Herbertson.**
[Commercial Geography of the World.] By Dr. A. Herbertson. London and Edinburgh: W. & R. Chambers, 1905. Size 7 × 5, pp. 152 and 268. *Maps. Price 3s. 6d. Presented by the Publishers.*

Economics. **Kropotkin.**
Fields, Factories, and Workshops, or Industry combined with Agriculture and Brain Work with Manual Work. By P. Kropotkin. Fourth Edition. New York: G. P. Putnam's Sons; London: Sonnenschein & Co., 1904. Size 7½ × 5, pp. x. and 260. *Illustrations. Price 6d. net. Presented by the Author.*

A reprint of the suggestive series of essays first published in collected form in 1898.

Economics. **Lindeman.**
Urbegriffe der Wirtschaftswissenschaft Arbeit: Wert (Gebrauchs- und Tauschwert), Geld, Preis; Wirtschaft, Wirtschaftswissenschaft. Von Dr. M. Lindeman. Dresden: O. V. Böhmert, 1904. Size 9½ × 6½, pp. xii. and 248. *Presented by the Author.*

The author points out the importance of including commercial geography in the field of political economy.

14, 15; XXX. 4, 8, 12, 16; XXXII. 16; XXXV. 8, 12, 16; XXXIX. 4; XLII. 4; XLIII. 14; XLVIII. 9, 10, 11, 12, 13, 14; XLIX. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13; L. 1, 2, 5, 6, 9; LIII. 8, 12; LIV. 8, 9, 10, 11, 12, 16; LV. 1, 5, 9, 13. *3s. each.*
(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographische Abteilung der K. Preuss. Landes-Aufnahme. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheet 290, Neuhaldensleben. Berlin, 1904. *Price* 1.50*m. each sheet.*

London. **Morden and Lea.**

Facsimile of Morden and Lea's Map of London, 1682, in 12 sheets. London: London Topographical Society, 1904.

The London Topographical Society has already issued several most interesting facsimiles of old plans of London, and it was their intention to publish a reproduction of the Agas map during the year 1904, but they have been unable to accomplish this, as it was found that the preparation involved more time and labour than would admit of any portion being ready during the year. They have, however, reproduced Morden and Lea's 'Prospect of London and Westminster,' which, although of a later date, is in some respects quite as interesting as the Agas map, especially as it was from a survey made soon after the rebuilding consequent upon the Great Fire; and, indeed, as will be seen from a note on the plan, St. Paul's cathedral was in course of reconstruction when the survey was made by "Wm. Morgan, His Majesties Cosmographer, 1681–2."

Pomerania. **Halbfass.**

Tiefenkarten hinterpommerscher Seen nach eigenen Lotungen im Sommer 1904, entworfen und gezeichnet von Dr. W. Halbfass. Scale 1 : 25,000 or 2·5 inches to one stat. mile. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 19. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

Spain and Portugal. **Albert.**

Mapa de los Ferrocarriles de España y Portugal por A. M. Albert. Con indices alfabeticos de todas las Estaciones, Apeaderos, Apartaderos y Cargaderos é indicacion del servicio que prestan los que lo tienen limitado. Scale 1 : 1,500,000 or 23·6 stat. miles to an inch. Madrid: P. Orrier, 1905.

An outline map without physical features, showing railways in different symbols in black. Numerous insets of special districts are given on enlarged scales, and the map is accompanied by an index.

ASIA.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 22 N.W., parts of Kathiawar and Kathiawar Agency and District Ahmedabad (Bombay Presidency), additions to 1902. 31 S.E., parts of districts Hissar and Ferozepore and Native States of Patiala (Punjab) and Bikaner (Rajputana Agency), additions to 1902. 32 S.E., parts of districts Hissar and Loharu State (Punjab), Jaipur and Bikaner States (Rajputana Agency), additions to 1891. 34 N.E., parts of district Ajmer and of Kishangarh, Jaipur, Tonk, Bundi, Udaipur, and Shahpura, Native States (Rajputana Agency), additions to 1903. 34 S.E., parts of district Ajmer and Native State of Udaipur, Jaipur, Kotah, Bundi, and Shahpura (Rajputana Agency), additions to 1903. 41 N.E., parts of districts Belgaum, Bijapur and Dharwar, and Kolhapur and Southern Maratha and Satara Agencies (Bombay Presidency), and district Lingsugur (Nizam's Dominions), 1903. 44 N.E., parts of districts Malabar and South Canara (Madras Presidency) and of Coorg, additions to railways to 1903. 44 S.E., part of district Malabar (Madras Presidency), additions to railways to 1903. 48 N.E., parts of districts Dehra Dun, Saharanpur, Garhwal, and Native State of Tehri Garhwal (U.P. Agra and Oudh), and districts Umballa, Karnal, and Native States of Sirmur, Patiala, and Kalsia (Punjab), additions to 1902. 49 S.E., parts of districts Gurgaon and Delhi (Punjab), Meerut, Bulandshahr, Muttra, Aligarh, and Moradabad (U.P. Agra and Oudh), additions to 1903. 51 N.E., parts of Native States Gwalior (C.I. Agency), Karauli, and Dholpur (Rajputana Agency), additions to 1904. 52 N.E., parts of districts Saugor (Central Provinces), and Jhansi (U.P. Agra and Oudh), and Native States of Gwalior (C.I. Agency), Tonk, and Jhalawar (Rajputana Agency), additions to 1901. 71 S.E., parts of districts Seoni, Mandla, Narsinghpur, Jubbulpore, and Balaghat (Central Provinces), additions to 1903. 72 N.E., parts of districts Nagpur, Seoni, Bhandara, Chhindwara, and Balaghat (Central Provinces), additions to 1903. 77 N.E., parts of

districts Nellore and Cuddapah (Madras Presidency), additions to 1899. 86 S.W., parts of districts Kheri, Sitapur, and Bahraich (United Provinces), and of Nepal, additions to 1903. 87 S.E., parts of districts Azamgarh, Gorakhpur, Basti, Fyzabad, Sultanpur, and Gonda (U.P. Agra and Oudh), additions to 1902. 90 S.E., parts of districts Sambalpur and Bilaspur (Central Provinces), and of Tributary State Sarguja (Bengal), additions to 1900. 91 S.E., parts of districts Raipur, Sambalpur, and Native State of Patna (Central Provinces), additions to 1903. 124 S.E., parts of districts Kamrup, Nowgong, Darrang, Cachar, Khasi, and Jaintia Hills, and Naga Hills (Assam), corrections to 1901. 125 N.W., parts of districts Kamrup, Sylhet, Khasi, and Jaintia Hills and Garo Hills (Assam), and of Mymensingh (Bengal), additions to 1903. 29, parts of districts Gujrat, Jhelum, Rawalpindi, Shahpur, Gujranwala, Gurdaspur, Kangra, and Sialkot (Punjab), and Kishtwar, Nowshera, Badrawar, and Jummu (Kashmir), additions to 1903. 54, parts of districts Hoshangabad, Nimar, Wardha, and Betul (Central Provinces), Amraoti, Akola, Buldana, and Ellichpur (Berar), Khandesh (Bombay Presidency), and of Native State Indore (C.I. Agency), additions to 1901.—Eastern Bengal Survey, 8 miles to an inch. Sheets: 11, parts of districts Darjeeling, Jalpaiguri (Bengal), and Goalpara (Assam), with Native States of Nepal, Sikkim, and Bhutan, additions to railways and boundaries to 1903. 15, parts of districts Tipperah, Noakhali, Chittagong Hill Tracts, and Native State Hill, Tipperah, additions to railway to June, 1898, 1903.—Western Bengal Survey, 8 miles to an inch. Sheets: 3, parts of districts Ranchi and Hazaribagh, the Garjat States, Chang Bhakhar, Koria, Sarguja, and Jashpur (Chota Nagpore Division), addition to railway to February, 1903. 4, Udepur, Gangpur, etc. (Garjat States of Chota Nagpore), and Athmallik (Orissa Tributary States), and part of district Ranchi (Bengal), additions and corrections to January, 1899, 1903. 6, districts Darbhanga, Muzaffarpur, and Champeran, and part of Nepal, additions and corrections to railways and boundaries to September, 1903.—Madras Presidency, 32 miles to an inch, additions to railways, roads, etc., to 1903, 1904.—Rajputana Agency, 16 miles to an inch. Second Edition, additions and corrections to boundaries, railways, etc., 1903; 2 sheets, 1904.—District Ahmedabad, 4 miles to an inch; 2 sheets, 1903.—District Nagpur (Central Provinces), 4 miles to an inch, 1903. —United Provinces of Agra and Oudh in May, 1903, 32 miles to an inch.—District Baradanki (U.P. Agra and Oudh), 4 miles to an inch, additions and corrections to 1902, 1903.—District Jubbulpore (Central Provinces), 4 miles to an inch, additions and corrections to roads, railways and boundaries to September, 1901, 1903.—District Sonthal Parganas (Lower Provinces, Bengal), 4 miles to an inch, additions and corrections to March, 1903.—Kangra, 2 miles to an inch; 4 sheets, 1903.—District Broach, 4 miles to an inch, 1904.—Assam Survey, 1 mile to an inch. Sheets: (Preliminary Edition) 39, districts Kamrup, Darrang, and Nowgong, Seasons 1883-87 and 1897-98, 1903; (Preliminary Edition) 86, districts Darrang and Sibsagar, Seasons 1888-90 and 1898-99, 1903; 100, districts Sibsagar and Lakhimpur, Seasons 1888-92 and 1898-99, 1903; 131, parts of districts Lakhimpur, Sibsagar, and the Naga Hills, Season 1889-90, 1903.—Bengal Survey, 1 mile to an inch. Sheets: (Preliminary Edition) 56, 85, district Saran, Seasons 1895-99, 1904; 67, parts of districts Ranchi, and Sirguja and Jashpur States (Chota Nagpore), Season 1865-66, correction to boundary to September, 1902, 1903; 110, districts Muzaffarpur and Champaran, Seasons 1893-96, corrections to 1903; 136, 166, 195, districts Cuttack and Puri, Seasons 1888-95 and 1895-96, 1903; 167, 197, district Puri, Seasons 1889-91 and 1894-96, 1904; 219, district Balasore, Seasons 1892-94, 1903; (Second Edition) 221, 222, districts Cuttack and Balasore, Seasons 1888-95, 1903; (Second Edition) 223, district Cuttack, Seasons 1888-89 and 1891-93, 1903; (Second Edition) 235, districts Sonthal Parganas and Birbhum, Seasons 1841-43 and 1849-51, 1903; 284, districts Burdwan and Nadia, Seasons 1853-56, 1903; 301, parts of districts Rajshahi, Dinajpur, and Malda, Seasons 1848-51 and 1857-60, 1903; 347, districts Mymensingh and Pabna, Seasons 1850-54, 1904; 348, districts Mymensingh, Dacca, and Pabna, Seasons 1850-54 and 1857-58, 1904.— Bombay Survey, 1 mile to an inch. Sheets: (Second Edition) 61, parts of Kathiawar Agency, Season 1873-74, additions to railways to 1893, 1903; 136, district Thana, Seasons 1881-83, 1902; 184, parts of Baroda State and of the Rewa Kantha Agency, Seasons 1883-85, additions to railway to 1902, 1903; 258, district Nasik, Season 1873-74, additions to railways to 1900, 1903.—Burma Survey, 1 mile to an inch. Sheets: (Preliminary Edition) 112 (N.S.), districts Minbu and Magwe, Seasons 1891-92 and 1896-98, 1901; 153 (N.S.) 154, parts of districts Myingyan and Magwe, Seasons 1895-96 and 1901-02, 1903; 156 (N.S.), parts of districts Magwe and Minbu, Seasons 1892-93 and 1901-02, 1903; (Preliminary

1 : 800,000 or 12·6 stat. miles to an inch. 4 sheets. [Paris: Service géographique de l'Armée, 1904.] *Price* 4 *fr.*

The geographical positions of the principal places given on this map are based upon the triangulation, carried out for the Service Geographique de l'Armée and the astronomical observations of numerous French explorers—N. N. Flamand, Flatters, Foureau, Gautier, Jacob, Teisserene de Bort, Count Deleuze, etc. To these positions have been adjusted the route surveys and traverses of numerous officers and others who during recent years have travelled in this region.

Egypt. **Survey Department, Cairo.**

Topographical Map of Giza Province. Scale 1 : 10,000 or 6·3 inches to a stat. mile. Sheet s.e. No. 13–5. Cairo: Survey Department, Public Works Ministry, 1904. *Presented by the Director-General, Survey Department, Cairo.*

AMERICA.

Canada. **Surveyor-General of Canada.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Donald Sheet (39), West of Fifth Meridian, revised to March 13, 1902. Kamloops Sheet (56), West of Sixth Meridian, revised to September 30, 1899. Ottawa: Surveyor-General's Office, [1904]. *Presented by the Surveyor-General of Canada.*

GENERAL.

Classical Atlas. **Grundy.**

Murray's Small Classical Atlas. Edited by G. B. Grundy, M.A., D.LITT. London: John Murray, 1904. *Price* 6*s.* *Presented by the Publisher.*

Murray's 'Classical Hand Maps,' which have recently been published under the supervision of Mr. G. B. Grundy, are already well known and appreciated. One of their chief recommendations is that great care has been taken with the hills and general relief of the countries with which they deal, and the manner in which these have been represented by colour tinting, certainly enables the names to be clearly read. The natural features of a country are so closely connected with its history that too great importance cannot be attached to their representation upon classical maps, and it is satisfactory to see that this fact is fully acknowledged by Mr. Grundy in the present atlas, as well as the maps already referred to. The maps in this atlas are generally similar in style to the 'Classical Hand Maps,' and are commendably clear. Only those names that are really necessary and of importance are given. The atlas contains altogether fourteen maps, and includes an important sheet of plans of the principal battlefields in Greek and Roman history. There is also a good index. Its small price (6*s.*) should bring it within the reach of all, and it will doubtless be found of great assistance to students of history generally.

German Colonies. **Sprigade and Moisel.**

Grosser Deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben von der Kolonial-Abteilung des Auswärtigen-Amts. Lieferung 4. Deutsch-Ostafrika. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 20, Kilimatinde: 23, Neu-Langenburg. Die Deutschen Besitzungen im Stillen Ocean und Kiautschou. Sheet 25. General Map. Scale 1 : 15,000,000 or 236·7 stat. miles to an inch. Berlin: Dietrich Reimer (Ernst Vohsen), 1904. *Presented by the Publisher.*

The sheets of German East Africa include the country to the east and north of Lake Nyasa between 4° 30′ and 12° S. lat. and 32° 50′ and 37° 10′ E. long. The third sheet in this part is a useful general map of the Western Pacific, with the German and other European territorial possessions clearly distinguished of different colours. This latter is a mere outline map, but serves well as an index to the more detailed sheets which are given in the others.

World. **Cowell.**

Time Chart of the World. Patented by Edward Cowell. Instant time in 160 important cities. London: George Philip & Son, Ltd., [1904]. *Price* 6*d.* *net.* *Presented by the Publisher.*

The meridian of Greenwich is shown by a vertical line running down the centre of the diagram, and twelve other meridians are drawn at intervals of an hour on either side of this vertical line. The principal cities of the world are laid down in their

respective longitudes relative to the meridian of Greenwich without any regard to latitude. Along the top of the diagram a separate slip of paper is placed, through slots. Upon this are marked the hours of the day and night, and by placing the hour of the day in line with the meridian of any place, the time of all other places on the diagram can of course be easily read off. Many diagrams of various kinds have been devised for showing the relative times of different places in the world, and it is doubtful if anything is gained here over the well-known circular form, which is certainly more durable than this.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand Atlas. 100 Karten in Kupferstich herausgegeben von Justus Perthes' Geographischer Austalt in Gotha. 39 u. 40 Lieferung. Gotha: Justus Perthes, 1904.

These parts, which are in one cover, contain the following maps: No. 7, Europe, by C. Scherrer, scale 1 : 15,000,000; No. 66, Indo-China and the Malay Archipelago, by C. Barich, scale 1 : 12,500,000; Nos. 73 and 74, Africa, by H. Habenicht, scale 1 : 7,500,000, sheets 5 and 6.

CHARTS.

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Chart No. 106, Golfo Corcovado: estero Palvitao, rio Yelcho, ensenada Chaiten. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Valparaiso: Oficina Hidrografica, Marine de Chile, 1904. *Presented by the Chilian Hydrographic Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for December, 1904, and January, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for January, 1905. London: Meteorological Office, 1904. *Price 6s. Presented by the Meteorological Office, London.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for January, 1905. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Argentine and Paraguay. ———

Six photographs of Northern Argentine and Paraguay. *Presented by Allan Brodie, Esq.*

These photographs are all interesting, but those of the Toba Indians are specially welcome to our collection.

(1) Government House, Formosa, Argentine Chaco; (2) A wood-cutting establishment in the Argentine Chaco; (3) Ruins of the church of Humayta, Paraguay; (4) A group of Toba Indians; (5) A Toba brave; (6) A tame Indian of the Toba tribe.

Egyptian Sudan. **Kearney.**

Sixty photographs of the White Nile and its tributaries, taken in September, 1903, by Mr. J. Kearney, under the direction of Captain H. G. Lyons, R.E., Director-General, Egyptian Survey Department, Cairo. *Presented by Sir William Garstin, G.C.M.G.*

These photographs were taken by Mr. J. Kearney, of the Egyptian Survey Department, during the time of flood in September, 1903. They are remarkably good specimens of platinotypes, and, as may be judged from the titles, are most characteristic of the region. Some of the views of the river-banks, papyrus growth, etc., are of special interest, as are also the native types.

(1) Cliff close to site of old Austrian mission, Gondokoro; (2 and 3) Looking upstream, Gondokoro; (4 and 5) View showing Nilometer, with river-gauge, Gondokoro; (6) Collector's house and office, Gondokoro; (7) Village outside Gondokoro; (8) Another village, Gondokoro; (9) Wives of Uganda (Sudanese) soldiers; (10) Lado, landing-place; (11) General view, Lado; (12) Landing-place at high flood, Mongalla; (13) Commandant's quarters, Mongalla; (14) Mongalla, Gebel Lado in distance; (15)

Sudanese soldiers' quarters, Mongalla; (16) View near landing-stage, Kiro; (17) Cliff of east bank of Bahr-el-Jebel, looking up-stream, Kiro; (18) European quarters, Kiro; (19) Congo soldiers' quarters, Kiro; (20) Congo women labourers, Kiro; (21 and 22) Sudd-cutting party's wooden station above Bor; (23) Euphorbia; (24) Village near Bor; (25) General view of Ghaba Shambe; (26) Group of Dinkas, Ghaba Shambe; (27 and 28) Papyrus, Bahr-el-Jebel opposite Hellet-en-Nuer; (29) Bahr-el-Jebel at Hellet-en-Nuer; (30) The Rohl, possible mouth of, entering Bahr-el-Ghazal; (31) Bahr-el-Ghazal, about 30 kilometres west of Lake No; (32) Bahr-el-Ghazal, blocked with grass sudd; (33 and 34) Floating sudd in the White Nile; (35) Shipping fuel; (36) Bahr-el-Zaraf, showing four hills forming Gebel Zaraf; (37–39) Sobat river, from Amerian Mission Station of Doleib Hills; (40) Group of Shilluks, Sobat river; (41 and 42) Three Shilluks, Sobat river; (43) Taufikia; (44) Native fishing, Taufikia; (45) Group of Shilluks, Taufikia; (46) Commandant Macnaghten, Taufikia; (47 and 48) Villages on White Nile, south of Kodok; (49) Mr. Craig preparing to measure a section of White Nile; (50) In the village of Kodok; (51) El Dueim on the White Nile; (52) Public gardens, Khartum; (53) Governor-General's palace. Khartum; (54) Post Office, Khartum; (55) Shilluk natives of the Lollé watching bird-shooting; (56) Renk, wood station, White Nile; (57) Shilluks on Sobat river; (58–60) Shilluks in dug-out.

Portuguese East Africa. **Reid.**

Twenty-five photographs of Gorongoza and Sheringoma territories, Portuguese East Africa, taken by R. L. Reid, Esq. *Presented by R. L. Reid, Esq.*

The expeditions during which these photographs were taken were described in the *Geographical Journal* for last month. Although immediately to the north of the Beira railway, the region through which Mr. Reid travelled is very imperfectly known, hence the photographs are of special value.

(1) View of interior of old Portuguese fort; (2) Portuguese store, Makaia; (3) View in midstream, Urema river, showing difficulty of travelling; (4) The turning-point of the Urema river; (5) Baobab tree on the M'Kodza river; (6) Borassus palm; (7) The "village blacksmith," Garopa; (8) Camp at Nyapiriri; (9) Camp at Inhambwe; (10) Camp at Nyabava; (11) Camp at Fontesvilla; (12) Some of the sport handed over to the Australian Government; (13) Buffalo; (14) Hippopotamus; (15 and 16) Crocodiles; (17) Eland; (18) Water-buck; (19) Lioness; (20) Cheeta; (21) Sable antelope; (22) Reedbuck; (23) Warthog; (24) Herd of Wildebeest on the Pungwe plains; (25) Hartebeest.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Zweite Reihe. Heft 3. Mexikanische Nadelhölzer. Von Dr. E. Stahl. Heft 4. Nordmexikanische Xerophyten. Von Dr. E. Stahl. Heft 5–7. Characterbilder mitteleuropaischer Waldbäume. I. Von Dr. Ludwig Klein. Jena: Gustav Fischer, 1904.

Victoria Falls. **Pedrotti.**

Nine photographs of the Victoria Falls, Zambezi river, taken by Mr. L. Pedrotti, Bulawayo. *Presented by A. J. C. Molyneux, Esq.*

An excellent series of large-size photographs, showing different views of the falls and characteristic vegetation of their vicinity. The positions from which the photographs have been taken were evidently carefully selected, with the most satisfactory result.

(1) View on the Zambezi, looking down-stream towards the falls; (2) View on the Zambezi, above the falls; (3) View looking into chasm from its western end; (4) The Grand falls; (5) View of falls seen through the jaws of the gorge; (6) View looking into chasm from eastern end; (7) View from second eastern promontory over depressed and narrow portion of "Knife Edge," with falls beyond; (8) View of bend in cañon; (9) View in rain-forest.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


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FROM SRINAGAR TO THE SOURCES OF THE CHOGO LUNGMA GLACIER.*

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It was my fortune to spend the summers of 1902 and 1903 in exploring, with Mrs. Fanny Bullock Workman, the hitherto unvisited upper portions of the Chogo Lungma, Hoh Lumba, Sos Bon, and Alchori glaciers. We were accompanied, in 1902, by the guide Mattia Zurbriggen and porter Giuseppi Muller, of Macugnaga, and in 1903 by the guides Joseph Petigax and Cyprien Savoie, with Laurent Petigax as porter, all of Courmayeur, who were engaged and sent to us in Kashmir by Signor Francesco Gonella, president of the Turin section of the Italian Alpine Club, and Signor Ettore Canzio, of Turin, well-known Italian alpinists, to whom we are greatly indebted for their prompt and friendly assistance. We had with us, also, in 1903, Mr. B. H. M. Hewett, of London, as topographer.

I invite you to revisit with me to-night that portion of our route, which lay between Srinagar and the sources of the Chogo Lungma, noting as briefly as possible some of its most salient features.

The Chogo Lungma, one of the largest of Himalayan glaciers, lies in the northern part of Baltistan, its termination or snout being just above the village of Arandu, in lat. 35° 52′ N. and long. 75° 23′ 40″ E., twenty-three marches north of Srinagar, the capital of Kashmir. It is best reached from Srinagar *viâ* Skardo, the chief town of Baltistan, and thence up the Shigar and Basha valleys.

* Read at the Royal Geographical Society, November 21, 1904. Map, p. 352. The map is based on theodolite survey by Mr. Hewett, corrected and supplemented from observations and photographs by Dr. William Hunter Workman and Mrs. Fanny Bullock Workman.

Several routes lead from Srinagar to Skardo, the shortest in twelve marches being up the Gilgit road to the Burzil Chowki and thence over the Deosai Plains. This route, owing to the elevation of the Deosai Plains, between 12,000 and 13,000 feet, and that of the Burji La, nearly 16,000 feet, is only free from snow and available for travel during July, August, and the first half of September.

The longer, more disagreeable, but more convenient and generally used route, because open the greater part of the year, takes one in eighteen marches up the Sind valley, praised for its scenery by summer visitors who have never been farther afield and beheld the supreme majesty of the wilder regions beyond, over the Zozi La, a low pass of about 11,000 feet to Kharbu, and thence down the valleys of the Dras and Indus.

The Dras and Indus valleys are dreary and desert, being walled in on both sides by high mountain barriers of scarred and gullied clay, crumbling granite, and shale, without vegetation, except here and there the aromatic shrub called boortsa and wild rose trees, which will flourish where nothing else will grow, and which often bear such a profusion of blossoms as to hide their stems entirely from view. They flash up in the stony wilderness like marvellous colour gems, each tree or group brilliant with every shade of mauve from the palest pearl to deepest crimson.

The path here is narrow and rough, running up and down steep ragged inclines, across gorges swept by mountain torrents, through stretches of soft sand, and over narrow ledges projecting from perpendicular rock walls which overhang rushing rivers beneath. Every 5 or 6 miles, usually at the entrance of side valleys, the landscape is varied by oases perched on the mountain flanks, or nestling at the bottom of the valley by the river-bank, beautiful in their bright spring green, or later, with their golden harvest, in striking contrast with the brown barren surroundings. The eye, wearied with the dull monotony of the chaos of rock and *débris* through which one has been passing, rests with delight on the terraced fields of waving grain, bordered by a profusion of mulberry, apricot, pear, walnut, poplar, and willow trees.

In the centre of the oases stand villages of a size proportioned to each, by the industry of whose inhabitants these gardens in the desert are created. Every available bit of alluvium among the rocks is cultivated, and good-sized terraces, bearing excellent crops, are seen, the alluvium of which has been brought in baskets from wherever it could be found in the neighbouring wilderness.

These oases are of artificial creation. The land on a sloping surface is built up in terraces, one above the other, retained by stone walls. A mountain torrent near by, which furnishes a never-failing supply of water, is tapped at a point above, and a canal constructed from it to carry the water along the upper side of the land to be reclaimed.

FIG. 1.—TYPICAL VIEW IN THE INDUS VALLEY NEAR TOLTI. PATH SEEN AT EXTREME RIGHT.

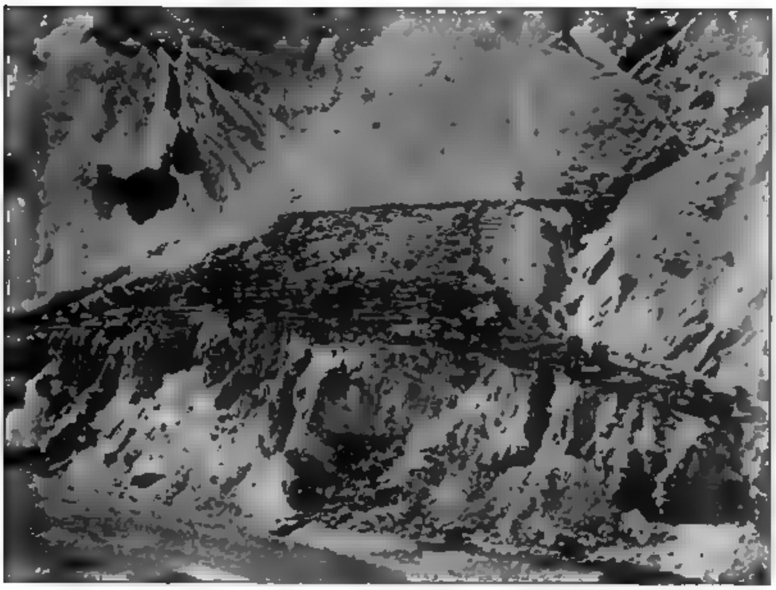

FIG. 2.—OASIS ON TALUS. WATER CANAL BORDERED BY TREES ABOVE. TO RIGHT, GORGE THROUGH WHICH WATER IS BROUGHT. IN FOREGROUND RIVER WITH HIGH BANK.

Openings are made in the canal walls at desired points, and the water is distributed as required over the whole series of terraces from top to bottom.

Oases like these, which form the homes of the greater part of the population of the mountain valleys, depend for their existence entirely on irrigation. Cut off the artificial water-supply, and they would become as arid as the desert wastes around them. The semi-barbarous Himalayan valley-dwellers, who in their habits are but little above their domestic animals, are experts in the art of irrigation, and have nothing to learn in regard to it from Western civilization. Their implements are simple, their methods of construction rude, but they apply the means at their disposal to the desired end in a manner absolutely scientific, and the results show their skill to the confines of the oases.

It is marvellous to see what crops are obtained from land that is often sandy and stony. Such luxuriant grain-fields I have seldom seen elsewhere. One is at first surprised at such results when one considers that these lands have been constantly under cultivation probably for untold thousands of years, that the cultivators have not at their command manure and other fertilizers such as are used in Western lands, and that they harvest their grain by pulling it up by the roots, thus leaving nothing in the ground to nourish future crops.

A little observation reveals the secret of their success. The sediment brought down from the mountains in the water of the streams is a potent fertilizer, which is kept constantly applied to the crops from the time they are planted till they are ripe for the harvest, so that the ground is continually enriched rather than exhausted.

One of the most interesting features of the Dras and Indus valleys is the evidence of water-erosion everywhere to be seen. Not only near the present level of the rivers, but at all elevations, even to the mountain-tops several thousand feet above, the granite rocks are smoothed, rounded, eroded in every conceivable manner and dented with pot-holes, showing that at some distant period they were subjected to the action of moving water carrying stones. Boulders of various sizes are strewn about at all levels, honeycombed in the most remarkable way, some being mere shells eroded both outside and inside.

From the shapes and positions of the pot-holes and erosions, it is evident that the direction of the currents that produced them was about the same as the flow of the two rivers at the present time. The erosions are seen mostly on the left banks of these rivers or west sides of the valleys, which slope away from the rivers much less precipitously than the right or east sides. The explanation of this, as well as the question whether the erosions were made at the levels where they now stand by water flowing thousands of feet above the present rivers, or at or near the river-levels and afterwards pushed up with the mountain

masses, I leave to those better equipped with geological knowledge than myself.

Skardo is situated in an amphitheatre among the mountains at the point of entrance of the Shigar into the Indus river, and is surrounded by imposing peaks. It is the most important town in Baltistan, being the seat of residence of the Tehsildar, and possessing a post-office, telegraph-office, sub-treasury, and bazaar. The Government maintains a meteorological station with mercurial barometer and other instruments, the readings of which at 8 o'clock a.m. are daily forwarded to the meteorological office at Calcutta. During both our expeditions to the Chogo Lungma and adjacent glaciers in 1902 and 1903, this served as our lower station for the calculation of altitudes, and the Government official kept a daily record of readings at 8 a.m., 12, and 3 p.m. for us.

A short distance above Skardo the Indus is crossed in a flat boat, and a large basin several miles in diameter, surrounded by mountains and deeply covered with sand, has to be traversed. The wind-storms, which rage here almost daily in the afternoon, have driven the sand into a series of remarkable sand-dunes. These take the shape of long elevated ridges and hillocks, surmounted by sharp arêtes and curling crests, some of which strongly resemble snow-cornices. I could not perceive that these last actually overhung the perpendicular, though I suspect they do when formed in damp weather, the overhanging portions afterwards crumbling and falling when dried by the burning sun, as loose sand was seen on the leeward slopes just below the sharp edges.

The sand acts like snow under the influence of the wind, and the result here was an exact counterpart of a high snow region exposed to strong winds. The tops of the highest of these hills and ridges must have been 300 feet or more above the general level of the basin. They were composed of fine white sand, whilst the lower slopes consisted of coarse sand driven into wavelets 3 or 4 inches deep, and from 3 to 12 feet in length.

From here the route leads up the wide Shigar valley, with its constant succession of villages situated on fertile alluvial fans, which radiate from the openings of the gorges cleaving the mountain barriers on either side. The Shigar valley is renowned for the quality of its apricots and mulberries, which are delicious, as well as for the abundance of its grain. The village of Shigar is the principal grain depôt of this region, and there we purchased the large supply of ata, or meal —some 4 tons—which in 1903 was required to feed the eighty-five coolies who accompanied us. The ata, which had to be forwarded in skin sacks eight to ten marches to us, shrunk about 20 per cent. in bulk at the hands of the coolies who carried it. As we paid for it in advance when ordering it, the burden of this shrinkage fell upon us, and not, as should have been the case, on the official who agreed to

deliver it under seal. One finds human nature much the same in all parts of the world. Some of the devices resorted to by these primitive Asiatics to overreach would do credit to the ingenuity of their more civilized neighbours of the western world.

In order to reach the Basha valley, at the head of which Arandu lies, a series of rushing, mud-laden streams, which anastomose with one another along the valley bed, has to be crossed. The passage of these is made by means of a primitive, apparently frail, but really staunch craft called a zak. This consists of goat skins, usually twenty-four in number, inflated and attached by woollen cords to six or eight slender poles placed parallel to one another. It is buoyant, and breasts the billows of the most turbulent streams in safety. It is managed by a crew of four men, armed with willow or poplar poles about 8 feet long, with which they push it with considerable skill across the rapid currents. It is so light that its crew can easily carry it to any desired point, and the skins can be deflated, detached from the poles, and packed for transport in a short time.

As it has no floor except the skeleton of poles, the passenger must be careful where he treads, or he will find himself stepping through into the water. He stoops so as to keep the centre of gravity low, balancing his feet on two poles whilst he grasps two others with his hands. The water of the seething torrents washes over the craft when well laden, often wetting the feet of the passenger to the ankles; but this is an incident he does not mind so that he gets safely over the river. The embarkation is made at a point hundreds of feet above the landing-place on the other side to allow for the rapidity of the current, which carries the zak swiftly downward. As only five or six persons can be carried at one time, several hours are required to get a caravan over a river.

The village of Arandu lies at an altitude of 9500 feet, on an alluvial terrace directly in front of the converging snouts of the Tippur glacier on the south and the Chogo Lungma on the west. This terrace differs from the other fertile oases in the valleys below in that it has no fruit trees, producing only grain and a few vegetables. It belongs to the Tippur slope rather than to that of the Chogo Lungma. It may be an alluvial fan washed out at some distant period from the Tippur nullah; but it seems more likely to be the termination of the talus sloping down from the mountain, which forms the opening wall of that valley on the west. This talus is continuous with the Arandu terrace, and for several hundred feet above it is covered with grass and other vegetation.

Arandu is a small village, and can muster only about thirty coolies. Its headman or lambardar accompanied us on both our expeditions to the Chogo Lungma, in charge of the coolies and their food. His moral code was not modelled after the strictest Christian ideals; and on one

occasion, when sent down to Arandu in an emergency to bring up supplies, although he knew we urgently needed all he could get, he did not hesitate to dispose, at a good price, of a sheep and several dozen eggs and fowls charged to our account, to a sportsman whom he met, telling us they were lost in the snow.

Still, though we never felt we could depend on his loyalty, through a judicious mixture of coaxing and threatening and promises of a good bakhshish he was induced to remain fairly faithful to us, and proved really useful in keeping the coolies up to their work. In comparison with the nine other Basha valley lambardars, we came to regard him almost as a friend and a pattern of Balti morality. The last attitude in which we remember him was that of prostration before us at the door of our tent, salaaming and touching his forehead repeatedly with his right hand in acknowledgment of the reward received for his devotion to our cause.

The Tippur glacier, which has never been explored, comes down through a gorge between precipitous rock mountains high above Arandu, and extends its snout, broken into séracs to the end to within 1846 feet of the village. It has evidently been advancing for several if not many years, for it has built entirely around the part outside the gorge a high and massive terminal moraine, above which the ice towers from 50 to 100 feet, and against which it crowds, overhanging it in many places. At the extreme end and at one other point the ice has broken over its moraine barrier, and a line of séracs projects halfway down the side of the latter.

The top of the moraine at the nearest point to the village is 415 feet above it. The glacier is adding to the moraine at a rapid rate, discharging upon it constant showers of boulders, rocks, and sand with a thunder which resounds through the air day and night. In short, this glacier may be considered at present to be in an aggressive mood. Formerly it reached considerably farther down the valley than now, the old terminal moraine being covered with a thick growth of grass, shrubs, willows, and tamarisks.

On the contrary, the snout of the far larger Chogo Lungma comes down its valley without fuss or noise to within 1184 feet of Arandu, where, on a level with the latter shelving away to a thin edge, it dies out like a spent wave almost imperceptibly on the river-bed.

The Chogo Lungma glacier runs a winding course nearly north of west from Arandu for a distance of 30 miles to its source in a col nearly 20,000 feet above sea-level. In these 30 miles it rises from a height of 9500 feet at Arandu to 19,000 feet at the base of the col. Its width varies from about a mile at its lower end to about 2 miles at its upper middle portion. For convenience of description, it may be divided into three sections, according to the distinguishing characteristics of each.

The first or lowest section extends from the end of the snout 9 miles

FIG. 3.—THE LAMBARDAR OF ARANDU AND HIS WIFE

FIG. 4.—THE SNOUT OF THE CHOGO LUNGMA GLACIER, WITH RIVER-BED AND CULTI[illegible]
FIELDS OF ARANDU IN FOREGROUND.

upward to a point above the first bend. The surface of this section is broken up into a confused mass of pointed hillocks, highest along the meridian line, sharp ridges, and deep ravines. It is so thickly covered with mud, sand, granite, conglomerate, and shaly detritus of every size, from small fragments to huge boulders and slabs, that ice is scarcely seen, and where it does appear it is black and smutty. Placed suddenly upon it, one could imagine one's self in a desert of torn and splintered rock rather than on a glacier.

What becomes of the immense mass of *débris* that covers this section to its very end it is difficult to conjecture. One might suppose that its accumulation would long ago have blocked the wide valley below with a wall hundreds of feet high, and buried the village of Arandu deep out of sight; but, little evidence of such accumulation is seen, and the fair fields of Arandu still lift their luxuriant burden of grain to the breezes, unharmed by the threatening monster above. There is no terminal moraine worth mention, only a few insignificant stone-heaps just beyond the end of the snout, left by the receding ice—a great contrast to the huge moraine enveloping the snout of the neighbouring Tipper glacier.

The snout itself projects from the glacier bed between the mountains like a gigantic stranded whale, its naked, sloping, glistening, black flank, at first some 200 feet high, tapering down to a small point. Some distance up on its side, near where it leaves the right lateral moraine, a good-sized river flows out from under it, which follows its edge nearly to its end, and then turns across the stone-strewn interval towards Arandu, beyond which it joins the stream coming down on the opposite side from the Kero Lungma to form the Basha river.

This section of the glacier has dwindled greatly from its former volume. Colonel Godwin Austen says that in 1862 the ice was encroaching on the Arandu terrace. Now it nowhere touches it, and has receded to a point 1184 feet west of the village. The signs of recession below the end of the snout are so faint, that one could not judge from them that more than a slight diminution in its actual length has occurred in recent years, but immediately one ascends the glacier the evidence is more pronounced. A quarter of a mile above the end the side of the snout has receded more than 200 feet from the high right lateral moraine.

On account of the broken and crevassed surface of the lower section of the glacier and the steepness of the mountain walls on the right bank, the only way to ascend it is to cross over it from Arandu to the left bank, and for the next 14 miles to follow the detritus-strewn space between the former lateral moraines and the present ones. Here the recession is very marked. The ice now lies at distances of 50 to 600 feet from the original bank, consisting of the mountain flanks, which are banded by large primary moraines.

Between these and the moraines adjoining the ice is a system of

more or less parallel secondary moraines, separated from one another by considerable intervals. At one place I counted six parallel moraines of this kind. From these we may infer (1) that the shrinkage has been going on for a long time, as is shown by the fact that the primary and some of the secondary moraines are covered with vegetation and trees; (2) that there have been periods of arrest in this process when the glacier was stationary or slightly advancing, during which the secondary moraines were formed; (3) that the glacier is still retreating, as the ice slants sharply back, and in some places has melted entirely away from the moraines last formed.

Just below the upper end of this section a well-marked moraine rises on the shoulder of a mountain spur more than 100 feet above the level of the ice opposite. To build this moraine, the surface of the glacier must have been from 150 to 200 feet higher than at present. This represents an important diminution of the glacier in thickness as well as in width. At no point in this section was it advancing or crowding its left lateral moraines, but everywhere receding from them.

At one place in the lower part of the second section, for a distance of more than 1500 feet, the ice, which in 1902 had receded from the lateral moraine, in 1903 was pressing hard against and overlapping it, owing probably to the increased thrust of the large branches opposite sent down from the Haramosh range.

At some points the lateral moraines are high and massive, at others small. The height of one was measured at 115 feet on the shorter side next the mountain, and others must have been 150 feet or more. In several places moraines were being formed along the sides of huge ice-walls, the process being the same as the formation of tali at the base of mountain precipices. In this case the *débris* near the edge of the glacier is set free by the melting of the ice, and, falling down the sloping side, accumulates in a moraine at the base.

Here and there along the left bank of the first and second sections of the glacier, examples occur of the sand, grass, flower, or bush covered maidans often seen on the sides of Himalayan glaciers. These are level or gently inclined meadows lying between the mountain slopes and the lateral moraines.

They are found at places where the slopes recede from the glacial bed, at the entrance of side valleys, and at the confluence of glaciers, where the lateral pressure is not great enough to force the glaciers against the mountain walls. The moraine barriers usually run in a straight line, except at the junction of glaciers, where pressure may cause them to be formed on a curve.

The maidans are, as a rule, free from stones, and, if at the entrance of side valleys, may have small clear streams running through them, hence they afford convenient and safe places for camping purposes.

In those I have examined no moraine deposits have been found on

FIG. 5.—SECTION OF LATERAL ICE-WALL OF BLACK ICE, ABOUT 200 FEET HIGH AND 400 LONG. MORAINE FORMING AT ITS BASE.

FIG. 6.—HARAMOSH GLACIER AT ITS ENTRANCE INTO THE CHOGO LUNGMA. MOUNT HARAMOSH, 24,270 FEET, 11 MILES AWAY AT EXTREME LEFT. IN BACKGROUND BEAUTIFUL SNOW-NEEDLES OF INDUS-NAGAR WATERSHED, PEAK NO. 4, 22,810 FEET HIGH. IN FRONT OF IT ROCK SPUR ENDING IN ROCK PEAK NAMED CHOGO LUNGMA RIFFELHORN, 15,337 FEET, ON WHICH IS SEEN LAYER OF BLACK SLATE LYING OVER THE GREY GRANITE. BASE CAMP ON SNOW-FLECKED SLOPE AT END.

the mountain slopes at the foot of which they lie, and which themselves are often covered with grass and flowers continuous with those of the maidan. Nor has such deposit been found upon or in the rich alluvial surface of many of the maidans or the sandy surface of others. The first evidence of moraine deposition is seen in the sharply defined enclosing moraines, which overlie the maidan surface as extraneous structures.

These facts, together with the important one that the maidans may be covered with a luxuriant growth of grass, flowers, or bushes, while the enclosing moraines may be destitute of any vegetation, point to the conclusion that the maidans were formed like any other terraces at a time antecedent to the formation of the moraines, and that the latter were superimposed on their edges at a later period, probably curtailing their area to a considerable extent.

These maidans must not be confounded with the spaces strewn with rock *débris* lying between primary and secondary lateral moraines.

The second section extends upwards for 13 miles, to a mountain wall above the entrance of the Haramosh glacier, where the Chogo Lungma makes a short turn to the south-west. This may be called the section of medial moraines, of which there are six well-marked ones, some of the larger presenting several distinct ridges, which, if counted as separate moraines, would swell the number to between fifteen and twenty.

At the beginning of this section, white ice first appears in the shape of a vast white tongue extending downward from above along the middle of the glacier. This is flanked by dark medial moraine-bands bearing the detritus already mentioned. Opposite the peak Kupultung Kung, owing to some cause which is not apparent, the moraines, which in places rise from 60 to 150 feet above the white ice, sink to the general level and lose their identity, joining together to form the chaotic structure seen lower down, the white ice disappearing from view.

As the glacier is ascended, two bands of white ice appear, separated by a huge moraine, the second originating in the Haramosh glacier, the largest branch of the Chogo Lungma. Throughout the second section the edges of the glacier are much broken and crevassed, owing to the entrance of branch glaciers on both sides, the crevasses being comparatively short, and running in various directions according to the pressure. To find one's way from the bank through the labyrinth of resulting séracs to the white ice in the middle requires considerable mountaineering skill, but once gained, the latter, being fairly smooth and free from large crevasses, affords a safe passage to the end of the section.

The bend of the glacier to the south-west forms a good-sized basin, into which open five large feeders of the great stream below, bearing somewhat the relation to it that the spread fingers do to the palm of the hand. Four of these we explored to their sources.

Projecting well into this basin, adjacent to the Haramosh glacier on the west, is a rock promontory, the end of a ragged spur sent off from the splendid so-called Indus Nagar watershed, peak No. 4, the most beautiful snow-needle I have anywhere seen. From this promontory rise two rock summits, one of which so strongly resembles the Riffelhorn at Zermatt, as seen from the Gorner glacier, that we christened it the Chogo Lungma Riffelhorn. Although a pygmy in comparison with the peaks around it, it is a giant as compared with the Zermatt peak, having an altitude of 15,337 feet to the latter's 9617. This summit is peculiar in that a wide band of black slaty rock is superimposed from bottom to top, on the granite of which it mainly consists. We scaled this several times during both seasons, and built a cairn on its summit, in which records were left.

On this promontory we established our base camp during the seasons of 1902 and 1903, and, as both summers were stormy, we spent considerable time here. It afforded an excellent point from which to study the region and the medial moraines. Records were also deposited in a cairn built at this camp.

The large Haramosh glacier sweeps down nearly at a right angle upon the Chogo Lungma with a thrust so great that the latter is pushed over towards its left bank, and the Haramosh turns to the right in a wide curve and crowds itself in on the right of the main stream, forming thenceforth nearly half the width of the glacier, and preserving its identity to the middle of the second section.

The detritus borne along on the left edge of the Haramosh glacier forms, at the line of junction with the Chogo Lungma, a large moraine in the middle of the glacier, which is pushed high up above the surrounding level by the lateral pressure of the two streams. Where the glaciers first come together, the moraine is not very pronounced, but it becomes more so as they descend. The granite of which it is composed has a reddish colour from the iron it contains. About a mile below the junction of the two glaciers, another medial moraine of black *débris* springs up by the side of the former without traceable origin, and after a short distance increases in size and height, rising 150 feet or more from the general level until it quite overshadows the Haramosh moraine, though it nowhere reaches more than half the width of the latter.

It is cleft by enormous transverse crevasses. Below the Bolucho branch these two moraines coalesce and present a uniform dark colour, sinking nearly to the level of the white ice. The detritus on the right side of the Haramosh glacier with that from the tributaries below, forms a wide right medial moraine belt with several moraines, whilst that from the left side of the basin and left tributaries forms a left medial moraine much narrower than the belt on the right.

The greater part of the *débris* of the left moraine appears to be cast out on the side to form the giant lateral moraines there seen, but sufficient

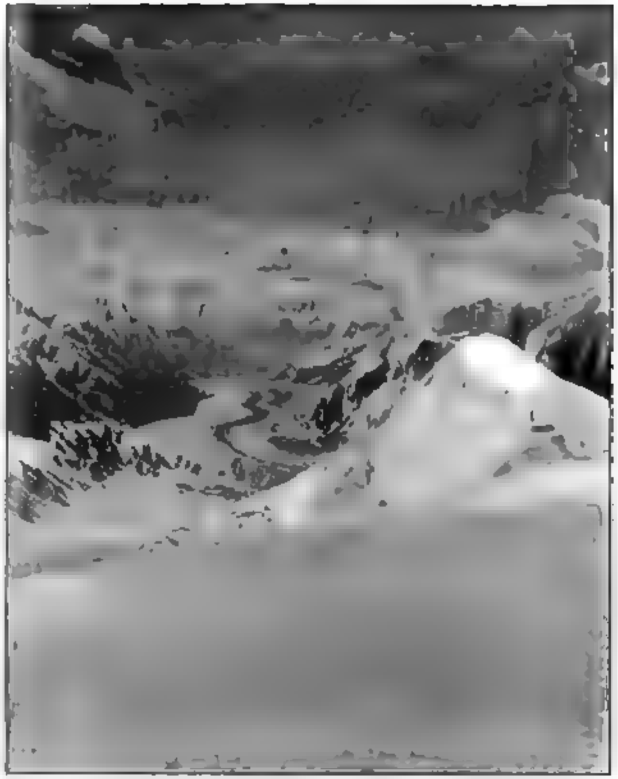

FIG. 7.—VIEW DOWN THE CHOGO LUNGMA FROM HEIGHT OF 18,700 FEET, SHOWING THE WINDING MORAINES. AT RIGHT SNOW-PEAK OF 17,814 FEET ASCENDED IN AUGUST, 1902.

FIG. 8. BASE CAMP ON RIFFELHORN SLOPE, TAKEN FROM ABOVE. GLACIER ABOUT 2 MILES WIDE. SÉRACS ON NEAR SIDE ICE-LAKE ABOUT HALF A MILE FROM GLACIER EDGE BELOW CAMP. BLACK LINE AT EXTREME RIGHT SHOWS THE BEGINNING OF THE LARGE HARAMOSH MORAINE WHERE GLACIERS FIRST COME TOGETHER.

is left with that of the right central ones to conceal the ice of the lowest section entirely from view.

The medial moraines mark the course of the ice-currents caused by the entrance of tributary glaciers and the conformation of the bed of the main stream. These currents, which are complicated, would make an interesting study for one who had time to devote to mapping them. Above the Riffel promontory, one black moraine originating under a mountain on the right bank pushes diagonally across the glacier some 3 miles to join the left latero-medial moraine.

Opposite Riffel camp a large depression occurs in the glacier, the surface of which here is much cut up by crevasses. In the centre of this there is a good-sized lake with streams running into and out of it. This presented the same appearance in 1903 as in 1902, and will probably continue to exist until the movement of the glacier opens an outlet in its bed.

The Haramosh glacier runs south by west from the Chogo Lungma 11 miles to the base of the steep flanks of Mount Haramosh (24,270 feet), where it ends in a long snow-covered ice-field or pass seamed with wide crevasses, which dips down steeply on the other side to a valley leading to the Indus. The height of this pass is 17,412 feet. As its discoverers, we named it the Amar Singh La, after General Raja Sir Amar Singh, K.C.S.I., of Kashmir. The scenery here is of the wildest and most sublime description, whole mountain slopes presenting a chaos of glittering ice-falls.

The third section of the Chogo Lungma comprises the remaining 8 miles to the col. In this distance the glacier rises 5000 feet, from 14,000 to 19,000, and is walled in by impressive mountains from 21,000 to 24,500 feet high, whose ice-clad sides rise sharply from it. Here moraines and rock *débris* cease to be prominent, their place being taken by a broken surface of séracs and icefalls, and higher up by *névé* and driven snow.

The séracs begin at Riffel promontory and continue for about a mile, spreading halfway across the glacier. They are largest and most broken near the right bank. Two other series occur above, rising so steeply as to constitute ice-falls. Wide crevasses of unmeasured depth exist over the whole of this portion, in some places in great numbers, in others more scattered. These crevasses do not run transversely from bank to bank as at one place on the Biafo glacier, but take every direction, often ending in huge ice-caverns. This indicates irregularity of the glacial bed. The general effect of the second ice-fall, about 3 miles above Riffel promontory, is, however, that of transverse terraces rising above one another.

This section is not easy to ascend. In addition to the steepness of the gradient and the effect of altitude on the system, one has to thread one's way through the pathless labyrinth of séracs, neither

a very easy nor safe operation, to contend with soft snow which increases in quantity as one ascends, till near the col it reaches a depth of over 3 feet, endure the burning heat of the sun in clear weather, and cold winds and cutting sleet in foul; camp on the glacier in soft snow, with a temperature falling perhaps to zero, and, worst of all, contend with the unwillingness of coolies to proceed, without whose aid nothing can be accomplished, running the almost certain risk of being forced back by them or of being deserted and left helpless in the snow in case the weather becomes threatening.

This is the formative basin of the glacier, an elevated savage wilderness of snow, ice, and rock. Here the snow collects with every storm throughout the year till it lies many feet deep on the solid ice beneath, to which it freezes, and whose volume it helps to swell. Large hanging glaciers pour down their ice contingent in tumultuous confusion to add to the masses below, while the precipitous mountain flanks hurl down snow and ice avalanches of enormous size with a force which causes the earth to tremble, and a thunder which is heard for miles. Avalanches here are constantly falling, and constitute an element of danger which has to be reckoned with in every move that is made.

Near the head of the glacier we narrowly escaped the largest avalanche it has ever been my fortune to see. The width of the glacier at this point is about a mile, the surface strongly undulating, and the mountain slopes on both sides extremely steep. As we passed along the middle of the glacier in front of one threatening wall we tried to hurry the coolies, whose movements, as usual, were of the most leisurely character. They gave little heed to our admonition, and would not quicken their pace.

The last coolie had passed the wall by only ten minutes, when we were startled by an ominous roar behind. Looking around, we saw what seemed to be the whole mountain-side in motion. The huge curling cornice that had graced its brow and excited our fears had broken loose. Vast masses of snow and solid ice were sliding downward, rolling over one another, leaping through the air, and smashing themselves against the rocks with hissing, growlings, and crashings, as if all the demons of the infernal regions were expending their wrath on that mountain wall. Thick clouds of snow-dust were thrown hundreds of feet in the air.

As the mass struck the glacier it seemed to hesitate a moment, then, gathering head, with a high swelling front at least half a mile wide, it shot across the glacier regardless of undulations and gradients, leaving in its train a chaos that must be seen to be appreciated, till it finally expended its force well over towards the farther side of the glacier. The cloud of snow-dust raised by it rolled majestically onward till it was dissipated on the heights opposite. The forces of nature

among these great mountains, when dormant, pass unobserved, but when aroused to action, be they those of air, water, rock, or snow, the effects are indescribably sublime and awe-inspiring.

Five miles from the col the last and highest tributary of the Chogo Lungma enters it from the south with a great, much-broken ice-fall, the confluence of the two forming a large slanting basin, the middle of which lies at an altitude of about 16,000 feet. This glacier is about a mile wide and 6 miles long. It is deeply covered with snow, as are the mountains around it, which discharge from both sides upon it avalanches that sweep its whole width. It is seamed with crevasses, some of which extend from one bank to the other. It ends in a snow-col above 19,000 feet in height, beyond which valleys descend towards the Indus and Gilgit.

From the entrance of this tributary to the base of the terminal col, 5 miles distant, the Chogo Lungma consists of a series of vast rounded ice-hillocks slanting sharply up to the mountains at the sides and rising steeply above one another, their surfaces broken by yawning ice-caverns, and deeply covered with snow. The ascent here is very fatiguing, resembling that of a stiff snow-mountain. The col itself crowns a massive ice-wall rising sharply from the glacier to an estimated height of 800 feet above it. The col is nearly 20,000 feet above sea-level. The continuity of the wall is broken by ice-falls and bergschrunds, and its whole surface is covered with a thick mantle of soft snow. We named this the Pratap Singh Col, in honour of His Highness the Maharaja of Kashmir and Jammu.

In August, 1902, after much trouble with our coolies, who were disheartened by the steep gradient and depth of the snow, we succeeded in reaching the base of this wall, and camped at a height of 18,995 feet with the intention of climbing it. In the afternoon we cut steps up the lower half, intending to make the ascent the next morning. At daylight clouds and mist began to roll over the col, and by seven o'clock it was entirely obscured from view. The barometer fell rapidly, and, as a storm was evidently on, we struck tents and beat a retreat to a camp at 15,096 feet, six hours below, on a mountain-side.

By ten o'clock snow was falling thick and fast. At one we pitched our tents in 4 inches of snow on the stone terraces we had previously built out from the rather steep slant for this purpose. That storm lasted sixty hours without interruption, during which time it kept us occupied in clearing away the snow from and about the tents to prevent their collapse. The next morning the fifty-five coolies who were with us deserted in a body, returning to the base camp, and left us alone with the camp-servants to weather the storm. After the storm had ceased forty of them returned, having been sent back by the lambardar.

A few days later the porters and two coolies went up to bring down the Mummery tents we had left behind with the intention of returning.

These were found buried under 5 feet of new snow. The depth of the snow, the lateness of the season, and the danger from avalanches prevented our returning to the col that season. During the stormy summer of 1903, there was so much snow on the glacier above 17,000 feet that we did not attempt to revisit it, knowing it would be impossible for loaded coolies to reach its base.

In 1902, when we made the terraces for the camp here seen, the mountain-side for 1000 feet above was free from snow. In July, 1903, the camp site was covered with avalanche *débris*. Our tent terraces and a strong stone cairn we built just above had been swept away by avalanches, resulting from the unusual accumulation of snow during the winter.

The upper section of the Chogo Lungma is bounded on the north by a massive mountain wall covered with ice, leading up to three splendid snow summits, the highest of which, over 24,500 feet, dominates the whole region. Taking advantage of a series of fine days in August, 1903, we pushed our camp to a height of 19,358 feet on the much-broken snow-flank of the first peak. On August 12, after scaling the first two peaks having altitudes of 21,500 and 22,567 feet respectively, the two guides, Petigax, Savoie, and myself succeeded in reaching a point on the south-west arête of the third, 23,394 feet in altitude, from which we had a wonderful view, three-quarters of a circle in extent, upon a billowy mass of glaciers, valleys, mountain ranges, and peaks of every shape and height. The Pratap Singh col beneath our feet, at the head of the Chogo Lungma, was seen to be the beginning of a snow pass, named by us the Pratap Singh La, that runs for some distance between high snow-peaks, and then suddenly drops down to a glacier that slopes gently away to a rock valley leading apparently toward Nagar. This route to Nagar would not be available to travellers on account of its mountaineering difficulties, and no coolies could be induced to pass the Pratap Singh La.

To do justice to the remaining branches of the Chogo Lungma would require an evening. They have their origin in high, wild, riven, and snow-covered rock basins, fall sharply, are split up by deep crevasses into ice-falls and séracs, and bring down immense quantities of mountain *débris* to the main glacier. Some of them are beautifully marked by moraines.

The southern branches, coming from higher and more snowy mountains, are larger than those on the north side, and are, apparently, not receding. Several of the northern branches have receded greatly, and some of the smaller ones have entirely disappeared. One of the large tributaries, the Bolucho, has ceased to have any connection with the Chogo Lungma, having retreated some distance up its valley, leaving its bed covered with a chaos of granite *débris*. Two large moraines on the mountain-sides at the valley opening show that the ice must formerly

FIG. 9.—SECTION OF THE ICE-LAKE, WITH ICE-WALL ON FURTHER SIDE.

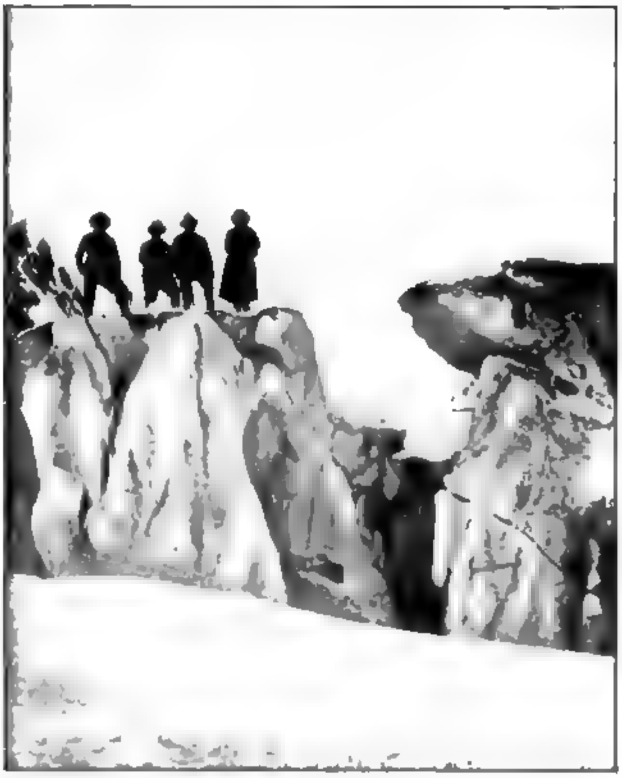

FIG. 10—ON THE EDGE OF A CREVASSE AT TOP OF ICE-FALL.

have been at least 250 feet thick at its junction with the Chogo Lungma.

It might be supposed that, at altitudes of 16,000 to 20,000 feet, in a region covered with ice and snow, where the temperature in the shade rarely exceeds 55° Fahr. at noon, and at night always falls as low as 20° Fahr., and sometimes to the neighbourhood of zero, one would not suffer from heat. The reverse is, however, the case. On clear and partially cloudy days, as soon as the sun appears above the mountains, the heat of its rays becomes quite sensible, and after nine o'clock one feels as if one were in a fiery furnace. The more snow there is—at these altitudes everything except perpendicular rock faces is usually covered with snow—and the fresher and whiter it is, the greater the heat. The reflected heat is as hard, if not harder, to bear than the direct heat of the sun, and shielding one's self from the direct rays of the latter affords no relief so long as one is exposed to the reflection from the snow. By noon, with new snow, the heat becomes intolerable, and together with the altitude causes headache and lassitude.

The effects of the reflected heat on the skin of Europeans are more severe than I have ever seen at sea-level or at low altitudes. The hands and face are soon burned to a deep copper red. The skin of the face becomes swelled, vesicated, and even blistered. The lips likewise swell, and become covered with exceedingly painful herpetic eruptions, which require a month to heal. In fact, one becomes so disfigured that one's best friends would not recognize one. The submaxillary glands enlarge and become tender in sympathy with the facial inflammation. The pain, especially from the lesions of the lips, is referred to the dental nerves, and the explorer often comes to doubt the integrity of teeth with which he has never before had occasion to quarrel. We tried to protect our faces by wearing white muslin masks, but, in spite of apertures for nose and mouth, we found they interfered with respiration to such a degree that they were cast aside as useless. Moreover, they were uncomfortable, the reflected heat burning strongly through them. In any case, to be really effective, the white muslin should have a lining of black or red, which combination has been found in the tropics to afford the best protection against the sun's heat.

As a comparison with the effect of heat on the skin in the Indian plain, I may state that in the course of our extensive cycle journey of 14,000 miles in India, Mrs. Fanny Bullock Workman and myself were exposed day after day for weeks together from morning till night to the full blaze of the Indian sun, in shade temperatures reaching above 100° Fahr., with no protection to our faces except a sola topi, and our faces were never burned so as to be in any degree painful.

The lighter the complexion the more one suffers from the reflected heat. The darker-skinned coolies and servants with us were not affected at all, whilst some with blue eyes, brown hair, and moderately

dark skin showed slight reddening of nose and cheeks, but nothing more. The Europeans of the party shed the cuticle of their faces every three or four days. This suggests that the application of burnt cork to the face might prove an efficient protection. We tried this for one day, after our faces had been painfully burned, and thought the skin felt cooler for it; but the disadvantages of this preventive, in the absence of water to wash it off with, were such that we did not repeat it.

The actual temperature of the sun's rays may be judged from the following figures. The maximum temperature taken with the black-bulb solar thermometer on the only ten available clear days between July 18 and August 17, 1903, at altitudes from 14,067 to 18,811 feet, ranged from 183° to 204° Fahr., the corresponding shade temperatures ranging from 47° to 60° Fahr. The average of these ten observations gives 190·75° Fahr. in the sun and 56·4° Fahr. in the shade.

Compare these with the highest sun and shade temperatures recorded during the summer of 1903 at two stations not much above sea-level in the plains. The figures were kindly given me by Sir John Eliot, M.A., F.R.S., K.C.S.I., Meteorological Reporter to the Government of India and Director-General of Indian Observatories. At Alipore, near Calcutta, the highest sun temperature was 161·9° Fahr. on May 22, the shade temperature being 106·2° Fahr. At Lahore the highest sun temperature was 172·6 Fahr. on May 31, the shade being 113° Fahr. The highest recorded sun temperature at these two representative stations in the plains was therefore 10·4° lower than the lowest maximum above 14,000 feet, and 31·6° lower than the highest.

The obvious deduction from these figures, and also from the physiological effects stated above, borne out by other observations, which want of time forbids me to cite here, is, that the higher the altitude and the thinner the air, the greater the energy with which the sun's rays strike the earth. The sudden change from great heat by day to severe frost at night is undoubtedly an important factor in the rapid disintegration which is taking place in the exposed rocks of these high Asiatic mountains. Nearly all the surface rocks of the mountains I have climbed in Baltistan have been found rotten and crumbling, the constituents of the sandstones and quartzites in particular having often so lost their cohesion that they could be rubbed to sand between the fingers.

The temperature of 204° Fahr. was registered at an altitude of 17,322 feet, the shade temperature being 56° Fahr. I do not consider this temperature abnormally high. The same figure was recorded at about the same altitude in 1902. It will be noticed that our maxima were obtained the latter half of July and the first half of August, at a time when the sun's rays had passed their greatest power, and that the much lower maxima at Alipore and Lahore were actually the highest records of the whole summer. On June 14, 1903, the sun

temperature at Shigar, at an altitude of about 8500 feet, was 206° Fahr. I have no doubt that, had the weather been more favourable, so that observations could have been taken at high altitudes in June and early in July, still higher readings would have been obtained. The thermometer used was compared and found to correspond with the most reliable one at the Government station at Lahore.

The tree-growth in the Chogo Lungma valley is scanty, consisting chiefly of willows and cedars, and these are found only on the north or left side. Willows cease at a height of about 11,600 feet, while cedars are scattered over the mountain slopes to about 12,800 feet. We found, cut up, and used for fuel many cedar trunks which had lain prostrate for an unknown period, larger than those of most of the trees now growing. The coolies, when not otherwise employed, were kept busy in transporting the fuel so obtained to our base camp above tree-growth.

Besides trees there is a species of bush, the name of which I do not know, which is found to a height of 14,400 feet, though stunted above 13,000 feet. This at its best attains a height of 10 to 12 feet. Its wood is hard, and it makes a much better fuel than the willows and cedars. Grass and some Alpine flora are found to about 15,000 feet in favoured spots. Above this is the domain of rock and ice.

Let us assume the snow-line to be at the altitude where the ordinary winter accumulation of snow remains on the ground at all seasons of the year. The determination of this line is difficult in a region like that around the Chogo Lungma, split up into irregular, ragged, towering peaks and deep, tortuous valleys. Many of the mountains far above the snow-line have such sharp slants and perpendicular faces that snow will not lodge on them, and these remain bare of snow at all times, while snow accumulates in their ravines at comparatively low altitudes to such an extent, that the heat of half a dozen summers would not melt it.

Snow-beds of this character are not unfrequently seen lying exposed to the sun throughout the summer as low as 12,000 feet. Glaciers, deep snow-beds, and perpendicular rock faces have to be eliminated from the problem, and the solution sought on even regular slopes, where the depth of snow represents the average snowfall. Such slopes near the snow-line are not easily found on the Chogo Lungma. But even with such the snow-line varies with the exposure, being higher on southern than on northern slopes, and it also varies with the season, being considerably lower after severe winters with great snowfall and in cold stormy summers, when snow covers the hills during every storm to points far below the actual snow-line. The snow-line is usually highest in this region about the end of August.

In August, 1902, in ascending the south side of a mountain 17,814 feet high, with a broad snow-capped top, we first encountered snow at 17,400 feet. The north side of this mountain was covered with snow

as low as 16,000 feet. On another peak not far from the Chogo Lungma of 17,600 feet, we found in July no snow except in small patches till the top was reached, and then only on the north slope, where it extended downward in a large snow-field. In July, 1903, both these peaks were snow-covered on their south sides for a long distance below their summits. The snow-line must therefore be considered indeterminate, and may be said to vary from 16,000 to nearly 18,000 feet according to season and exposure.

Measurements were made by Mr. Hewett at two stations to determine the movement of the glacier. The first station was on the north bank 15 miles above the termination of the glacier. The movement in twenty-four hours—

At a point	1583	feet from the station	was found	to be	1·59	feet.
"	1902	"	"	"	3·16	"
"	2828	"	"	"	2·40	"
"	4084	"	"	"	3·29	"
"	5021	"	"	"	2·45	"
"	5094	"	"	"	3·08	"

The second station was on the south bank 3 miles higher, just below the entrance of the Haramosh glacier. The movement here in twenty-four hours—

At a point	1302	feet from the station	was found	to be	1·40	feet
"	1502	"	"	"	1·83	"
"	3140	"	"	"	2·42	"
"	3305	"	"	"	2·69	"

These observations are not carried sufficiently far to permit of any extended deductions being made from them. They appear to show that at certain points on two lines running transversely across the glacier, the ice was moving at different rates, varying from 580 to 1200 feet per annum, which indicated the existence of different ice-currents moving at different speeds. How far the speed observed for a given point would be preserved is uncertain. Could the same points be identified farther up or down the glacier, probably their rates of movement, both actual and relative, would be found quite different from those observed.

The first set of figures are so irregular among themselves, that no conclusion as to the movement of the glacier as a whole can be drawn from them. It is possible that the lateral pressure of the Haramosh glacier, which even here must be considerable, together with that from other branches, might cause the ice-currents of the left half of the glacier to move among themselves with the velocities indicated; but this is mere supposition.

On the contrary, the points on the second or upper line have an increasing rate of movement from the station towards the centre of the glacier, showing that they were moving on the radius of a curve,

FIG. 11.—SNOW-CAPPED SÉRAC OF BLACK ICE NEAR EDGE OF GLACIER. STEEP MOUNTAIN-SIDE IN BACKGROUND, ON WHICH PATH MAY BE SEEN. ON ONE EXPEDITION WE GOT UPON THE GLACIER BY THREADING THE SÉRAC LABYRINTH JUST ABOVE THIS, BUT, ON OUR RETURN FOUR DAYS LATER, FOUND OUR BRIDGES WRECKED BY MOVEMENTS OF GLACIER, AND HAD TO FIND A NEW PATH, THROUGH SÉRACS LIKE THOSE HERE SEEN BELOW IT.

FIG. 12.—ON PEAK OF 17,814 FEET ASCENDED IN 1902. RISING FROM THE SAME RIDGE MASSIF AT DISTANCE OF SEVERAL MILES ARE TWO PEAKS OF 21,500 FEET, NAMED MOUNT CHOGO, 22,568 FEET, NAMED MOUNT LUNGMA, ASCENDED IN AUGUST, 1903, AND A PEAK OF OVER 24,500 FEET, ASCENDED TO A HEIGHT OF 23,394 FEET.

which represents just what was happening, the station being situated where the Haramosh glacier sweeps around in a great curve to force itself in on the right of the Chogo Lungma.

The opinion has often been expressed of late years that mountain sickness may be largely or wholly avoided by a gradual approach to high altitudes, so as to permit the system to become accustomed to diminished pressure and oxygen. Without discussing this opinion at length, I would cite a few facts bearing on it, which came under my notice during our expeditions in this region.

I have climbed in the Himalayas with eight other Europeans—nine in all. Of these, seven have reached altitudes of 21,000 feet, five an altitude of over 22,500 feet, and three that of practically 23,400 feet. No one of the nine, so far as I know, ever suffered from mountain sickness. We have ascended comparatively rapidly, usually reaching heights of 17,000 to 18,000 feet within a month after leaving sea-level. Much of our work above that height has been done within six weeks, and our highest at two months and a half.

In crossing the Skoro La in 1899, we took with us thirty-five coolies, who had lived all their lives at an altitude of about 8500 feet, and most of whom had crossed the 17,000-feet Skoro La to Askole more than once. The first day they made a light march of only three hours. The second day, at an altitude of about 15,500 feet, half of them were so prostrated by mountain sickness that we were obliged to encamp on a steep and exposed mountain-side.

In 1902, while ascending the Chogo Lungma, my instrument coolie, who had always lived in Arandu, 9500 feet, became very ill at 12,500 feet, and continued so for two days, after which he recovered and went with us to 19,000 feet without further trouble. The following year, after staying idle at our base camp at 14,000 feet for two weeks, he became severely ill again at 15,500 feet.

In 1903, out of twenty-two coolies from villages at altitudes of 9000 to 9500 feet, who were in excellent condition, having lived a life of ease for a month at our 14,000-foot base camp, during which time they had all put on flesh from the consumption of double the rations they would have used had they been obliged to furnish their own provisions, eight became so ill at 19,600 feet, that they lay like logs on the snow, oblivious to all attempts short of actual violence to induce them to move.

Whatever may be the effect of a prolonged sojourn at high altitudes as a modifier or preventive of mountain sickness, it is certain that a large proportion of our coolies, who had a lifelong advantage over us of 8500 to 9500 feet, besides that of being on their native ground, suffered severely from this affection, while the nine Europeans escaped entirely.

It seems to be the case with mountain sickness as with sea sickness, the symptoms of which two maladies are practically identical, though

the causes differ, (1) that some persons are immune to it at any altitudes that have been reached and under all circumstances; (2) that others are affected at given altitudes on some occasions and not on others, according to the amount of fatigue undergone and the condition of their bodily health; (3) that still others always suffer at certain elevations, just as some persons always become sea-sick on moderately rough water. How far the last two classes may be benefited by a prolonged sojourn at high altitude can only be determined by further experience.

The weather in this region, from the middle of June to the last week in August, is extremely uncertain. The monsoon makes its influence felt with prevailing winds from the south and west and a large number of stormy days. During the summer of 1902, there were rarely more than two clear days in succession, and only on one occasion did the number amount to four.

In 1903, with one interval of three fine days early in July, and five from August 8 to 12, there were only a few days when it was not stormy or the sky covered with heavy clouds. Much good work can be done on glaciers up to 17,000 feet in spite of unfavourable weather conditions; but it is not safe to attempt high-mountain climbing, where snow-camps must be made and several successive clear days are an absolute necessity.

In both seasons the weather became fine the last week in August, and continued so till September 12. So far as the weather is concerned, this seems to be the best time for high-snow exploration, but the disadvantage of short days and long nights, with increased cold, has to be incurred.

Exploring in these high regions is extremely fascinating, involving conditions not met with lower down. Were the available transport means, now so uncertain and unsatisfactory, at all adequate to the work in hand, many interesting questions connected with nature at high altitudes might be thoroughly investigated, which, as matters now stand, can only occasionally be touched upon.

In closing, I show a telephotograph of one of the most beautiful and striking of the Chogo Lungma peaks. We parted with the glacier and its mountains with regret after two seasons of most interesting association, during which we had studied them in their different moods, feeling that bonds of friendship with them were being severed which had been cemented by the vicissitudes of sunshine and storm.

NOTE.—In the autumn of 1903, after reports of our Baltistan expedition reached Europe, Major Max Schlagintweit published a statement in the *Mitteilungen*, that his brother, Adolf Schlagintweit, was the first to explore the Chogo Lungma region in 1856, and referred to vol. i. of the travels of the brothers Schlagintweit in support of this contention.

A careful examination of the books by the brothers Schlagintweit in the Library of the Royal Geographical Society in London and in the Royal Library

in Munich, as well as in that of the D. O. A. V. in Munich, including the work mentioned, fails to discover any mention whatever of the Chogo Lungma glacier or even of Arandu at its termination. Further, neither the Chogo Lungma nor Arandu is indicated on the elaborate maps which accompany the large work of the brothers Schlagintweit. Had Adolf Schlagintweit visited even the termination of so important a glacier as the Chogo Lungma, he certainly would not have failed to mention it in his writings and show it on his maps.

Before the reading of the paper, the PRESIDENT said: I have now great pleasure in introducing to the meeting our friend Dr. Hunter Workman, who will give us an interesting account of the exploration of some of the Himalayan glaciers.

After the reading of the paper, the PRESIDENT said: There are many things in Dr. Workman's interesting paper which might lead to discussion, and we have present with us this evening a most distinguished member of the old Indian Survey, whom I regret to say now seldom favours us with his presence, Colonel Godwin Austen, who is, I believe, the only surviving member of what I consider to be one of the most brilliant and accurate geographical pieces of work that ever was performed, namely, the Kashmir Survey. I hope Colonel Godwin Austen will now address us on the subject of Dr. Workman's paper.

Lieut.-Colonel GODWIN AUSTEN: It is almost superfluous for me to say how very much I have enjoyed looking at the beautiful series of photographs which Dr. Hunter Workman has shown us this evening. I have no doubt you have enjoyed looking at these photographs of Alpine scenery, to me it has even been a greater pleasure, because in the years 1860 and 1861 I was surveying these magnificent mountains. No one can imagine the magnificence of that scenery. I have had the privilege of reading Dr. Workman's paper. Early in his discourse he mentions the Indus valley and the wonderful effects of water-action and erosion on the hills on either side. That is perfectly true. The portion of the Indus valley, from the junction of the Dras river down to Skardo, is a wonderful gorge. You see there the action of former glaciation and beds of gravel and sand at an enormous height above the present level of the rivers; in fact, the glacial scenery you have been looking at this evening is only the remnant of the great glaciers that once filled those valleys. One of the pictures that you saw on the screen was the rock of Skardo that stands up in the middle of the valley. My work took me to visit the trigonometrical station at the top of that rock. There is an enormous transported block which has been left lying on the summit of that hill, and you have only to look round the sides of the valley of Skardo to see the enormous accumulation of gravel and sand that once filled the valley. The fact is that the history of the Indus valley has never been written. It goes back long into Tertiary times, and it has not only been excavated, but it has been filled up high with detritus, which has all been swept clean out of it again, and you only see now the remains of forces that were once in action. Perhaps one of the most interesting points is the end of the Arandu glacier. It is evident, from the photographs shown us this evening, and from Dr. Workman's description of it, that it has very much changed in the forty years since I was there. I have brought up with me a water-colour sketch of the end of the glacier, which I made in the year 1861. It shows quite a different outline from what it is at present. Again, the north bank of the glacier all the way up shows it has receded very much from the side of the mountain from what it was in 1861. At that time it abutted against the mountain-sides the whole way down, cutting off the drainage of the side valleys and formed a series of small lakes, all of which have disappeared since that time. The Arandu glacier, which we have heard about this evening, was first visited by Mr. G. T. Vigne in the

year 1835. He was the first Englishman who ever went into Baltistan, and he was the first to give an account of the large size and form seen from Arundo, but he never went up the glacier. He was followed by one or two others—I think Dr. Thompson was one—but they never went up the glacier any distance. The main trunk is pretty well known. I followed it up for about 22 to 25 miles, not in direct line. Frederick Drew, about three years after I was there, got, perhaps, a little further than I did, because he crossed to the centre. I did not go across the glacier, but made the attempt where the principal tributaries join; however, the glacier was terribly fissured, and I made such slow progress that I saw there was no hope of doing anything. I had a great deal of survey work to finish elsewhere, and I came back. It has remained for Dr. and Mrs. Workman's party to explore the recesses of this great glacier. It was very brave for Mrs. Bullock Workman to face all the discomforts of heat and cold and snow and exposure which work of that sort entails, and I am only glad to find there are travellers who will spend their time so admirably and so beneficially for us who live at home, and for all who are interested in great physical features — who spend their time on work of that sort, and come back with such beautiful photographs as we have seen to-night. I might say a great deal more about what you have seen this evening, but there is one thing I should like to mention. I think the word "la," at the end of the name of the Rajah of Kashmir (Pratap Singh La) is not correct, and also in the case of the Amar Singh La, because the term "la," which is in general use throughout the whole of Tibet, from Baltistan to Lhasa and Bhutan, means a pass that is used for traffic, the highest portion of a road over a water-parting, and therefore I think it better to call depressions which are not used for traffic "colls," which is a more correct term than the word "la." I will not say anything further, except to again express my pleasure at seeing the photographs which we have had put before us this evening.

Colonel WAHAB: Personally I feel that we Indian surveyors, whose work takes us to the higher Himalayas, ought to be able to do more than we have hitherto done to extend our knowledge of glacial phenomena in those regions. Since the days of the Kashmir survey, however, when triangulation was being extended over the north-western Himalaya, very few officers have had the necessary opportunities—for although surveys have been pushed up to the snows on the Sikkim, Kumaon, and Punjab borders in recent years, nothing beyond reconnaissance work on small scales has been attempted in the remoter regions; the occasional political missions, also, which have crossed the high ranges, have not given time for any adequate mapping on scales large enough to illustrate the glaciation of the country.

Detailed surveys of the higher Himalaya have, in fact, never been regarded as within the scope of the Indian survey, nor, while so much work of importance elsewhere remains undone, is it to be expected that they should. For this reason, while we as Indian surveyors regret that we cannot ourselves take up work of such interest, we welcome travellers like Dr. and Mrs. Bullock Workman, who are prepared to place their experience and resources at the disposal of science, and to undertake what a utilitarian Government naturally does not feel justified in attempting. What is required to illustrate glacial phenomena is an accurate examination of a definite area, such as that of the Chogo Lungma and its tributary glaciers, so graphically described in Dr. Workman's lecture, and a careful re-examination of the area after a few years, so as to determine from actual observation the movement and variation of the glacier. Refined measurements, such as those periodically made on the Rhône glacier, would probably be impracticable at such a distance from civilization; but in a region where glacial phenomena are on so vast a scale as in the Himalaya, rougher methods would no doubt give valuable results.

It is to be hoped that the interest aroused in Himalayan exploration by the journeys of Mr. Douglas Freshfield and Dr. and Mrs. Workman will induce others to follow in their footsteps, and thus add a higher and more scientific value to their journeys and those of their predecessors.

The PRESIDENT: Mr. Freshfield is unable to attend here, but he has written a letter containing some interesting remarks which I am afraid there is hardly time to read at this late hour of the evening, but which will be printed with the paper. So it now only remains for us to pass a very cordial vote of thanks to Dr. Workman for his most interesting paper, and for the entertaining and beautiful views which he has been so kind as to put on the screen for us.

Mr. DOUGLAS W. FRESHFIELD sends the following:—

I very much regret I have been prevented to-night from listening to Dr. Hunter Workman's paper. I have studied it with great interest and sincere admiration, not only of the pluck and perseverance of Dr. Workman as a mountaineer, but also of the powers of scientific observation and graphic description shown by him as an author.

There are several points I should like to have commented on, which I will briefly mention here—

(1) With regard to water-erosion and the pot-holes found high on the mountain sides. Is it possible that these were formed when the slopes were more extensively buried in glaciers by subglacial torrents? These, as we all know, are peculiarly active in the formation of pot-holes, a pot-hole being almost the necessary complement of the *moulin* (or shaft), through which the torrent falls from the surface to the bed of the glacier.

(2) The fact that of two glaciers of which the lower ends are closely adjacent, one should be advancing and the other in retreat, is, as I pointed out at Cambridge, not so surprising as it may appear at first sight. The interval between the date when an increase of material is poured into the reservoir of a glacier and that of the corresponding advance of its snout is regulated by a variety of conditions, of which the chief are the length of the ice-stream, its bulk, and the angle of its bed. To put it in the simplest form of words, short and steep glaciers answer to an increase in their food supply more quickly than long and comparatively level glaciers.

(3) The absence or rarity of great terminal moraines may, I think, best be accounted for by the action of floods in carrying away all but the heaviest blocks.

(4) In general features, the glacier described corresponds to those under Kangchenjunga; in both cases the lowest portion is, as described by Dr. Workman, a desert of torn and splintered rocks. The first surveyors imagined the lowest 5 miles of the Zemu glacier to be moraine, and called it so on their map.

With regard to one of the chief obstacles to Himalayan exploration, the effects of high altitudes on the human frame, I welcome in Dr. Workman's narrative the confirmation by a medical expert of my own experiences. Immunity from mountain sickness, I agree, is not to be obtained by training—by living above 10,000 feet for a period. I have rather found the reverse to be the case; mountain-sickness is very much like sea-sickness: good sailors and mountaineers are more often born than made; that is, the immunity is mainly constitutional.

Again, the discomforts all, or almost all, climbers suffer from are not progressive from 12,000 feet upwards. On the contrary, in many instances they diminish above 15,000 feet.

A few years ago it was argued by very competent Alpine climbers that it was *a priori* impossible for men to climb, at any rate do more than crawl, at 22,000 to 24,000 feet. That argument can no longer be maintained.

Avalanches are a danger which it is, I hold, the duty of every climber who has been in these regions to insist on. They are on a scale wholly different from those of the Alps, and Alpine experience is at first likely to be misleading. Mr. Mummery's fate supplies the most emphatic warning on this point.

A minor but very serious trouble is the inflammation of the lips, mentioned by Dr. Workman. It becomes torture to eat, and men cannot climb without eating. Perhaps Dr. Workman may be able to suggest a palliative. I found boracic ointment useful.

The greatest difficulties in the way of climbers in the Himalaya are weather and transport.

As to weather, I can only suggest that some year luck may reward patience, and a climbing party get the ten consecutive fine midsummer days needed for an assault on a great peak. They must wait on the spot to profit by them.

As to transport, I see little hope until the Indian Government co-operates with an attempt to climb K² or Kangchenjunga, as the Home Government has co-operated with Arctic expeditions; until it puts fifty militarily trained and disciplined mountaineers at an explorer's disposal. Without this help a money grant would be little use; with it a relatively small sum, £1000 or £2000, might accomplish that desirable end—the conquest of the highest mountain in the world. We have heard lately a great deal of the moral qualities called out by polar exploration. I venture to think they are also called out to a great extent in mountaineering at high altitudes. There is surely some reason in the rhyme of the poet—it is true he was a mad poet—Blake—

> "Great things are done when men and mountains meet;
> These are not done by jostling in the street."

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART VII.—LOCHS OF THE SHIEL DISTRICT.

In this paper it is proposed to deal with the results of the work of the Lake Survey among the lochs lying near the borders of Argyllshire and Inverness-shire, viz. (1) Lochs Shiel and Dilate, which drain by the river Shiel into Loch Moidart; (2) Loch Eilt, which flows by the river Ailort into Loch Ailort; and (3) Lochs Màma, na Creige Duibhe, and Dubh, which drain into Loch nan Uamh. The relative positions of these lochs are shown in the index map (Fig. 1). The principal loch is Loch Shiel, lying on the boundary-line between Argyll and Inverness, while Loch Dilate lies in Argyllshire, and the other lochs mentioned are situated in Inverness-shire. Mr. Garrett drew up some notes on Lochs Eilt, Dubh, Màma, and na Creige Duibhe before leaving for Borneo, and these have been embodied in this article.

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* Plates, p. 352.

1. Lochs of the Shiel Basin.

There are only two lochs belonging to this basin to be dealt with here, viz. Lochs Shiel and Dilate; one or two other small lochs within the basin (the principal one being Lochan Dubh, at the head of Glen Hurich) were not sounded.

Loch Shiel (see Plates I. and II.).—Loch Shiel is one of the larger Scottish fresh-water lochs, having a total length of 17½ miles. In this

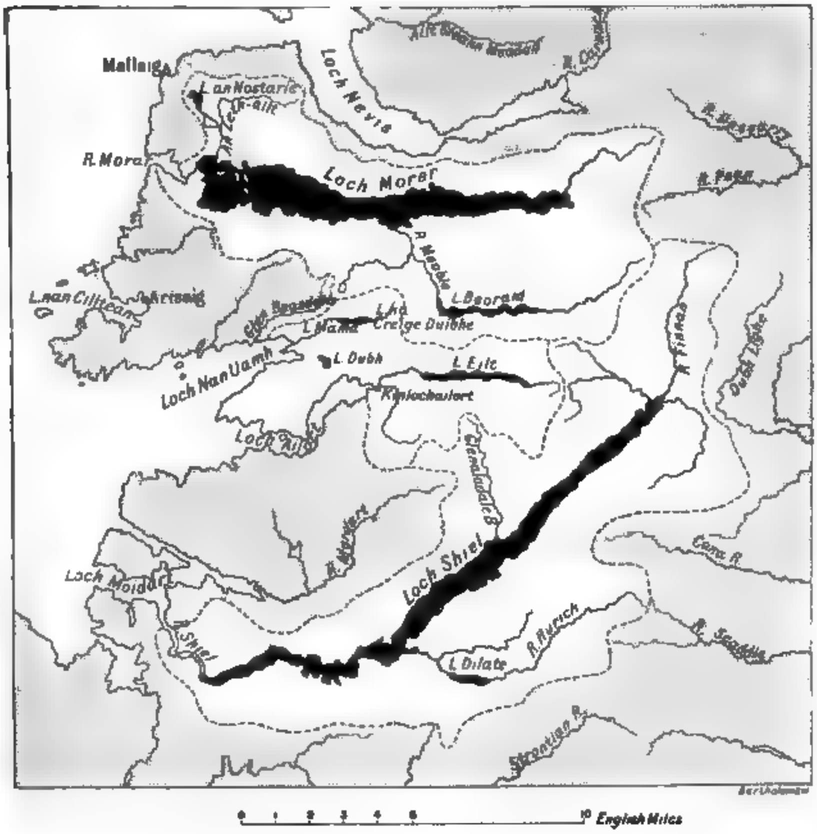

FIG. 1.—INDEX MAP OF THE SHIEL DISTRICT.

respect it is inferior only to Lochs Awe, Ness, and Lomond, which are 23, 22¾, and 22 miles in length respectively, and is closely followed by Loch Shin, which is 17¼ miles in length. Its elevation above the sea is only 11½ feet, so that a slight subsidence of the strip of land through which the river Shiel flows would convert it into an arm of the sea. Seals occasionally make their way into this loch from the sea at the present time. The principal upper portion of the loch trends in a

north-east and south-west direction, but about 6 miles above the outflow there is a bend in the outline of the loch, and the lower portion trends almost due west. The river Shiel follows a north-westerly course for about 2 miles before emptying itself into Loch Moidart. The scenery around the loch is very fine, becoming grand and wild towards the head. At the foot of the loch the surrounding ground is low, but on proceeding up the loch mountainous country borders the loch on both sides, culminating in heights exceeding 3000 feet at the head of Glen Finnan. To the south rises Ben Resipol (2774 feet), between Loch Shiel and Loch Sunart; to the east Sgor an Tarinachain (2474 feet), Meall Mor (2487 feet), Meall nan Creag Leac (2474 feet), Glas Garbh (2369 feet), Meall Doire na Mnatha (2094 feet); to the north Beinn nan Tom (2603 feet), Streap (2988 feet), Sgor Choileam (3164 feet), Sgor nan Coireachan (3133 feet), Fraoch-bheinn (2489 feet); to the west Beinn Odhar (2895 feet), Druim Fiaclach (2851 feet), a' Chroit-bheinn (2178 feet), and Beinn Gaire (2179 feet). The principal feeders are the river Finnan, Amhainn Shlatach, and Callop river, which enter the loch at its head, Glenaladale river entering about 6 miles down on the north-western shore, and the river Polloch (bearing the outflow from Loch Dilate) entering about 11 miles down on the south-eastern shore, where the bend in the trend of the loch occurs. There are numerous small islands and a few larger ones, the largest being Eilean Gleann Fhionainn at the head of the loch, while on Eilean Fhianain, at the narrows towards the foot of the loch, are the remains of St. Finnan's Church and a romantic burying-place of the Clanranald. At the head of the loch stands Prince Charlie's monument, erected by the late Colonel Macdonald, of Glenaladale, on the spot where that ill-fated prince raised his standard. Salmon, grilse, sea-trout, and brown trout abound in the loch, and yield fair sport, some of the salmon and trout being very heavy.

Considering its great length, Loch Shiel is very narrow, for at no place does the loch attain a width of a mile, the maximum breadth being about nine-tenths of a mile, and this occurs at the great bend in the outline of the loch, opposite the entrance of the river Polloch. The mean breadth of the loch is less than half a mile, being only 2½ per cent. of the length—a smaller percentage than has been observed in any of the larger lochs surveyed by the Lake Survey, the lochs most nearly approaching it in this respect being Loch Shin with 3 per cent., and Loch Ness with 4·3 per cent. The waters of Loch Shiel cover an area of about 4840 acres, or over 7½ square miles, and it drains directly an area of over 72½ square miles, but, since it receives the outflow from Loch Dilate, its total drainage area is about 85½ square miles—an area over eleven times greater than that of the loch. Over 700 soundings were taken, the maximum depth recorded being 420 feet, about 4 miles from the head of the loch, between the heights of Beinn a' Chaoruinn

and Beinn Odhar Bheag to the north-west, and of Meall nan Creag Leac to the south-east. The volume of water contained in the loch is estimated at 17,215 million cubic feet, and the mean depth at 81½ feet, or nearly 20 per cent. of the maximum depth. Loch Shiel was surveyed on July 2 to 9, 1902. The elevation of the lake surface above the sea was determined by levelling from bench-mark as being 11·4 feet; when levelled by the officers of the Ordnance Survey on November 6, 1897, the elevation was found to be 12 feet above sea-level. The water may rise 4 to 5 feet higher than the level given above.

The floor of Loch Shiel is on the whole rather irregular. The

FIG. 2.—LOCH SHIEL, FROM PRINCE CHARLIE'S MONUMENT.
(*Photo by T. N. Johnston, M.B., C.M.*)

50-feet contour-line encloses a continuous area extending from close to the upper end to within 2 miles from the lower end at Acharacle, but all the deeper contours are broken up so as to enclose two or more isolated areas. The 50-feet contour follows approximately the general outline of the loch, but it is in places of a sinuous character. At the head of the loch it extends both to the north-west and south-east of Eilean Ghleann Fhionainn. About 2 miles down there are sinuosities in the contour on both sides of the loch, due to a tongue of deep water projecting between the south-eastern shore and the island Sgeir Ghiubhsachain, and to a shoaling of the water off the north-western shore from 33 to 15 feet. Further down, off the north-western shore, above the entrance of the Glenaladale river, there is a twist in the 50-feet

contour, where the water shoals from 55 to 20 feet. Still further down, opposite the entrance of the Allt na Dalach, sinuosities in the 50-feet contour occur on both sides of the loch, the water shoaling off the south-eastern shore from 47 to 35 feet, and off the north-western shore from 41 to 19 and 22 feet. The last-mentioned shoaling occurs to the north-east of Eileanan Comhlach, at the entrance of the Allt a' Ghiubhais, and it is curious to observe a similar shoaling on the opposite (south-west) side of the island from 41 to 18 and 21 feet, while between the island and the mouth of the stream a depth of 32 feet was observed.

Towards the lower end of the wide part of the loch, and almost due south of Eilean Druim nan Laogh (or Heron island, as it is now called in the district), there is, near the middle of the loch, a shoal covered by only 2 or 3 feet of water. During the visit of the Lake Survey the regular mail steamer was laid up for repairs, having shortly before struck on this shoal and damaged the propeller. The captain of the steamer supplied information as to the position of the shoal, and the local gillie employed by the surveyors stated that in calm weather the bottom can be seen, but in the stormy weather prevailing at the time of the survey he was unable to find it, so that it must be of very small extent, for deep soundings were recorded near the spot indicated. The same gillie stated that a shoal bank extended from Ruadh Bac na Moine in an approximately south-west direction towards the opposite shore; this was confirmed by fishermen, and is probably indicated by the outward bend of the 50-feet contour-line at that place.

The 100-feet contour-line is less sinuous in character than the 50-feet contour, the main basin being about 12 miles in length, extending from near the head of the loch to the narrows at Eilean Fhianain, with two small subsidiary basins — one off Rudha Leathan, about 3½ miles from the foot of the loch, based on a sounding of 112 feet; the other between the promontory on the south-eastern shore called Rudha Torr a' Chonnaidh and the outlying islands, about 7 miles from the head of the loch, based on a sounding of 148 feet. A remarkable rise of the bottom was observed within the main 100-feet basin, about a mile above the entrance of the river Polloch, where soundings of 84 and 43 feet were taken, surrounded on all sides by about 150 feet of water. The contour of the lake-floor along this line of soundings is shown in cross-section C–D on the map (Plate I.).

The main 200-feet basin is nearly 8 miles in length, approaching to within half a mile from the head of the loch, and extending as far down as Eileanan Comhlach. There are two small subsidiary basins, separated from the main basin by an interval of over half a mile, between the entrace of the Allt na Claise on the south-eastern shore and the entrance of the An Garbh-allt on the north-western shore. This line of soundings shows a curious configuration of the bottom, which rises in the central part of the loch and sinks again on both sides nearer the

shore: thus, on proceeding from south-east to north-west the water deepens to 201 feet, then shoals to 122 feet, then deepens again to 172, 209, and 224 feet, shoaling again towards the north-western shore. It is interesting to note the close proximity of these two small deep basins to the rise covered by 43 feet of water already mentioned. The 200-feet contour shows a peculiar loop off the north-western shore, about 4 miles from the head of the loch, where the water shoals from 199 to 163 feet.

FIG. 3.—LOCH SHIEL, FROM HIGH GROUND AT THE HEAD OF THE LOCH.
(*Photo by Mr. David Brigham.*)

The principal 300-feet basin is distant about a mile from the head of the loch, and extends down the loch for over 4 miles, enclosing the deepest parts of the loch. Separated from this basin by an interval of a quarter of a mile (in which the greatest depth is 282 feet) is a second small basin based upon a sounding of 307 feet, and after a similar interval (in which the greatest depth is 284 feet) there is a third 300-feet basin 2 miles in length, having a maximum depth of 385 feet. Within this third basin there is a slight rise of the bottom covered by 288 feet of water; the line of soundings on which this rise is situated is shown in cross-section E–F on map (Plate II.).

There are two small basins with depths exceeding 400 feet, the smaller about 3 miles from the head of the loch, based on soundings of 416 and 419 feet, separated by an interval of three-quarters of a mile (in which the greatest depth is 375 feet) from the larger, which is less than a mile in length and encloses the maximum depth of the loch (420 feet), recorded near the north-eastern end of this larger basin, and over 4 miles from the head of the loch. The line of soundings which includes the deepest one, is shown on cross-section G–H on map (Plate II.).

From the foregoing description, it will be noticed that in Loch Shiel the deeper water occurs towards the head of the loch. Proceeding from Acharacle at the foot of the loch, one must row 2 miles up before encountering a depth of 50 feet; a further $1\frac{1}{2}$ miles before meeting with a depth of 100 feet, and this merely a small patch, a further $1\frac{1}{2}$ miles having to be traversed before reaching the main 100-feet basin, or a total distance of 5 miles from the foot of the loch. The main 200-feet basin is distant about 9 miles, the lower 300-feet basin nearly 10 miles, and the principal 400-feet basin over 12 miles, from the foot of the loch.

The areas between the consecutive contour-lines drawn at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 100	2632	54·4
100 „ 200	968	20·0
200 „ 300	711	14·7
300 „ 400	484	10·0
over 400	45	0·9
	4840	100·0

This table shows that more than half of the entire floor of Loch Shiel is covered by less than 100 feet of water, and about three-fourths by less than 200 feet, while only 1 per cent. is covered by water exceeding 400 feet in depth. The slope of the bottom is on the whole gentle, but in certain places deep water was found comparatively close inshore, and the consequent crowding of the contour-lines indicates a steeper slope than usual in these positions.

Temperature Observations.—Numerous observations were made on the temperature of the surface water of Loch Shiel during the week spent on the survey, the range observed being 8°·2, from 54°·2 to 62°·4. Three serial temperatures were taken beneath the surface, with the following results:—

TABLE OF SERIAL TEMPERATURES TAKEN IN LOCH SHIEL.

Depth in feet.	July 5, 1902, 6 p.m. Off Scamodale.	July 8, 1902. Off Eilean Druim nan-Laogh.	July 9, 1902, 5 p.m. 3 miles from head of loch.
	° Fahr.	° Fahr.	° Fahr.
0	57·1	55·9	56·5
5	—	54·9	—
10	57·0	54·5	—
20	56·3	54·4	56·5
30	55·5	—	—
50	50·2	54·0	56·0
75	—	50·9	—
100	47·0	47·0	47·4
130	—	46·2	—
200	45·7	—	45·2
280	45·3	—	—
300	—	—	45·2
400	—	—	45·3

In this table the observations are arranged chronologically, but the series given in the first column was taken about midway between the other two series, the second column giving a series taken towards the foot, and the third column a series taken towards the head, of the loch. The central series in the first column was taken three days earlier than the others, and is therefore not strictly comparable; it shows a higher temperature in the surface waters, and a lower temperature at a depth of 50 feet, than in either of the others. The temperature observed near the foot of the loch was lower at all depths than that observed towards the head, the difference amounting to 2° at 20 and at 50 feet, and to 0°·4 at 100 feet. The most pronounced fall in temperature was recorded between 50 and 100 feet towards the two ends of the loch, but between 30 and 50 feet in the central series (first column). The range of temperature shown by these serial observations is about 12°, while the extreme range of all the observations from surface to bottom during the week spent on the survey is over 17°.

Loch Dilate (see Plate III.).—Loch Dilate (or Doilate) lies about 1½ miles to the east of the lower portion of Loch Shiel, into which it flows by the river Polloch entering Loch Shiel about 6 miles above its outflow. The ground between the two lochs is low, the fall from Loch Dilate to Loch Shiel being only 10½ feet, but high and mountainous country surrounds Loch Dilate in all other directions. The principal feeder is the river Hurich, which takes its rise in Lochan Dubh at the head of Glen Hurich, and after a course of 6 miles empties itself into the east end of Loch Dilate. The loch trends east and west, and is nearly 1½ miles in length. It is widest towards the east end, where the maximum breadth is over one-third of a mile, the mean breadth being about one-seventh of a mile. Its waters cover an area of about 142 acres, or nearly a quarter of a square mile, and it drains an area fifty-eight times greater, or nearly 13 square miles. Forty-five

soundings were taken in Loch Dilate, the maximum depth observed being 55 feet. The volume of water contained in the loch is estimated at 145 million cubic feet, and the mean depth at 23½ feet, or 43 per cent. of the maximum depth. The loch was surveyed on July 8, 1902, and the elevation of the lake surface above the sea by levelling from benchmark was found to be 22 feet. When levelled by the officers of the Ordnance Survey on October 16, 1867, the elevation was found to be 23·4 feet above sea-level.

Loch Dilate forms a simple basin, the deeper water being centrally placed, and the contour-lines following approximately the outline of the loch. A sounding of 12 feet was recorded off the bay in the south-east corner of the loch, apparently surrounded by shallower water, though possibly continuous with the 10-feet area, but this is the only irregularity in the lake-floor indicated by the soundings. Along the central portion of the southern shore the contour-lines closely hug the shore, indicating a comparatively steep slope in this locality. A section along the central line of the loch from west to east is shown in section A–B on the map. The areas between the contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	78 ...	55·4
25 „ 50	49 ...	34·3
Over 50	15 ...	10·3
	142	100·0

Temperature Observations.—The following serial temperatures were taken at 3 p.m. on July 8, 1902, in the deepest part of Loch Dilate:—

Surface	62°·3 Fahr.
10 feet	62°·3 „
20 „	62°·3 „
25 „	61°·5 „
30 „	55°·3 „
50 „	53°·3 „

This series shows a constant temperature from the surface down to a depth of 20 feet, a slight fall of 0°·8 between 20 and 25 feet, then a very rapid fall of 6°·0 between 25 and 30 feet (a fall exceeding 1° per foot of depth), and a further fall of 2° between 30 and 50 feet, the extreme range of temperature being 9° Fahr.

2. *Ailort Basin.*

Loch Eilt is the only loch to be dealt with here; the few very small hill lochs within the basin were not surveyed.

Loch Eilt (see Plate IV.)—Loch Eilt lies about 1½ miles to the east of the head of Loch Ailort (into which its outflow is carried by the river Ailort), and about 4 miles to the west of Glenfinnan. The hills

around it rise steeply up to a height of over 1500 feet, the highest points exceeding 2000 feet. It was formerly considered a good loch for salmon and sea-trout; but Mr. Harvie-Brown believes that the blasting operations during the construction of the Mallaig extension of the West Highland railway resulted in the destruction of a large amount of spawn and fry, and that now the fish are greatly disturbed by the passage of the trains across the bays on the south shore.

Loch Eilt trends east and west, and is $3\frac{1}{2}$ miles in length, with a

FIG. 1.—LOCH EILT, LOOKING EAST

(*Photo by Mr. David Brigham.*)

maximum breadth of half a mile, the mean breadth being one-fifth of a mile. Its waters cover an area of about 424 acres, or two-thirds of a square mile, and it drains an area of 12 square miles. Over 250 soundings were taken, the maximum depth recorded being 119 feet. The volume of water contained in the loch is estimated at 686 million cubic feet, and the mean depth at 37 feet. The loch was surveyed on July 9 and 10, 1902; the elevation of the lake-surface was found, by levelling from bench-marks, to be 96·4 feet above the sea. The keeper stated that the water might rise about 3 feet above, and fall about

9 inches below, this level. During the night of July 9 and 10, 1902, the water rose nearly 10 inches.

Loch Eilt is naturally divided into three portions by two narrow constrictions in its outline, the western portion being by far the largest and deepest, covering an area of about 360 acres, while the area of the central and eastern portions is in each case about 32 acres. The western portion is connected with the central portion by a channel 6 feet in depth, with a rocky islet in the centre, the sides of the channel being also of rock *in situ*, thus dividing the loch into two rock-basins; the central portion is separated from the eastern portion by detritus brought down by the Allt a' Choire Bhuidhe, the channel between them having a depth of 7 feet. The small eastern and central basins are quite simple in conformation, the maximum depth observed in the eastern one being 52 feet, and in the central one 70 feet. The floor of the large western basin is much more irregular, there being four areas with depths exceeding 50 feet: (1) a small area near the east end, based on a sounding of 52 feet; (2) the main 50-feet area, which encloses the deepest part of the loch, over a mile in length, and with a rocky islet rising to the surface near its western margin; (3) a small area between the large island (Eilean Mòr) and the northern shore, based on a sounding of 55 feet; and (4) a small area near the west end, based on two soundings of 55 feet. At the extreme west end of the loch, between the two islands, a depth of 40 feet was recorded. The 75-feet area is about half a mile, and the 100-feet area about a quarter of a mile, in length, occupying the wide central part of the western basin, but rather nearer the east than the west end. The deepest part of the loch falls below sea-level (the 100-feet contour-line corresponding approximately with the level of the sea), and is flat-bottomed in character, as shown in cross-section C–D on the map.

The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	187	44·1
25 „ 50	111	26·0
50 „ 75	88	20·9
75 „ 100	20	4·8
Over 100	18	4·2
	424	100·0

Temperature Observations.—The temperature of the surface water in Loch Eilt during the two days spent on it varied from 58° to 60° Fahr., while the air-temperature varied from 53°·5 to 57°·9. On July 10, 1902, three series of temperatures were taken beneath the surface, one in each of the three basins into which the loch is divided, with the following results:—

Depth in feet.	Loch Eilt (eastern basin). July 10, 1902, 2.30 p.m.	Loch Eilt (central basin). July 10, 1902, 3.30 p.m.	Loch Eilt (western basin). July 10, 1902, 5 p.m.
	° Fahr.	° Fahr.	° Fahr.
Surface	58·0	58·1	60·0
10	58·0	58·1	60·0
20	58·0	58·1	60·0
27·5	55·7	57·7	60·0
35	52·8	53·6	59·7
50	50·7	52·8	54·8
75	—	—	53·0
100	—	—	51·0

These series show a constant temperature down to 20 feet in each case, but the water in the deep western basin was 2° warmer than in the other two basins. Beyond the depth of 20 feet, again, the temperature was about 2° higher in the western basin than in the central basin, and 2° higher in the central basin than in the eastern basin, so that at a depth of 100 feet in the western basin the temperature was rather higher than at a depth of 50 feet in the eastern basin. The water in the western basin was warmer at all depths than that in the central basin, and in the central basin than in the eastern basin. To explain this peculiar distribution of temperature in the waters of Loch Eilt on the afternoon of July 10, 1902, the weather conditions during the few preceding days must be taken into account. The wind had been blowing strong from the north-east from the 3rd till the afternoon of the 9th. Rain commenced to fall about 6 a.m. on the 9th, and continued till about 8 a.m. on the 10th, so that during the twelve hours from 9 p.m. on the 9th to 9 a.m. on the 10th the surface of the loch rose 9¾ inches. About 11.30 a.m. on the 10th the wind rose from the west, and by 4 p.m. was blowing a gale, so much so that the greatest difficulty was experienced in keeping the boat in position for the 5 p.m. series of temperatures. It would thus appear that the easterly winds of the previous week had blown the warm surface water into the western portion of the loch, and the west wind of the 10th had not yet had time to reverse this effect; the fact that the area draining into the western basin is nearly double that draining into the other two basins would doubtless accentuate this result, since more water would enter the western basin than the other basins, and this inflowing water at this season of the year would be warmer than the water of the loch. The range of temperature from surface to bottom in the eastern basin was 7°·3 Fahr., the greatest fall being 5°·2 between 20 and 35 feet; in the central basin the range was 5°·3, the greatest fall being 4°·5, also between 20 and 35 feet; in the western or main basin the range was 9° (representing the extreme range observed throughout the entire loch), and the greatest fall was 4°·9 between 35 and 50 feet.

3. *Lochs of the nan Uamh Basin.*

The lochs to be dealt with here are Loch Dubh, between the head of Loch Ailort and the head of Loch nan Uamh, and Lochs Màma and na Creige Duibhe lying to the north-east. Loch Doir' a' Gherrain in Ardnish could not be sounded, because there was no boat on it at the time of the visit of the Lake Survey.

Loch Dubh (see Plate V.).—Loch Dubh is a small loch situated at the head of the peninsula of Ardnish, which separates Loch Ailort from Loch nan Uamh, the two branches of the Sound of Arisaig. The Mallaig extension of the West Highland railway runs along its southern shore, and the outfall flows through the old bed of the little Lochan Deabhta, which has been completely drained by the railway, leaving only a channel through it for the escape of the waters from Loch Dubh. After leaving Lochan Deabhta the outfall joins the Schoolhouse burn, which has been deflected, thence into the Arnabol burn, falling into the head of Loch Beag, an inlet of Loch nan Uamh. It is surrounded, except on the western side, by low though steep hills, which impart a dark and sullen appearance to the loch, hence its name—the Black loch. Considering its superficial area, it is the deepest loch visited by the Lake Survey.* Its great depth, and the remarkable temperature conditions discovered in it, well repaid the trouble of carting a boat from Loch nan Uamh and carrying it down to the loch. Its catchment area is very small, and it would seem that the unpleasant taste of its water, resembling that of a stagnant pool, is due to the small amount of fresh water entering it. This unpleasantness is probably something more than mere taste, for attempts to stock the loch with trout have been unsuccessful, the fish rapidly dying; eels, however, abound in it.

Loch Dubh trends in a north-west and south-east direction, the broadest part being rather near the south-east end. Its length is under half a mile, its maximum breadth one-sixth of a mile, and its mean breadth one-tenth of a mile. Its waters cover an area of about 32 acres, and it drains an area eight times greater, or about 262 acres. Sixty-five soundings were taken, and the maximum depth observed was 153 feet, which bears the ratio to the length of the loch of 1 to 15. This low ratio is only equalled by the little loch on Eilean Subhainn in Loch Maree, and the loch which most nearly approaches it is Loch Fender in the Tay basin, in which the ratio is as 1 to 22, followed by Loch Dhugaill, near Kishorn, in which the ratio is as 1 to 27. Among the larger Scottish lochs, the nearest approach is found in Loch Treig, with a ratio of depth to length of 1 to 62. The volume of water

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* The deepest lake in East Prussia is, according to Halbfass (*Globus*, Bd. 86, p. 187, September 15, 1904), the Wuchsnigsee, which is about $1\frac{1}{4}$ miles in length, and has a maximum depth of about 210 feet. Loch Dubh is less than half a mile in length, and its maximum depth is 153 feet.

contained in the loch is estimated at 86,956,000 cubic feet, and the mean depth at nearly 63 feet, or 41 per cent. of the maximum depth. The loch was surveyed on July 12, 1902; the elevation of the lake surface above the sea was found, by levelling from bench-marks, to be 103 feet; when visited by the Ordnance Survey officers on August 6, 1869, the elevation was 103·3 feet above sea-level. No drift-marks were seen, but the keeper stated that the annual range in level was about 9 inches.

Loch Dubh is very simple in conformation, the contour-lines following approximately the shore-line. Near the north-west end there is a slight rise of the bottom, as shown in section A–B on the map, but otherwise the lake-floor slopes down regularly to the deepest part, which lies towards the north-eastern shore. The maximum depth of 153 feet was observed at a distance of about 120 feet from this shore, giving a slope of 59°; the height of the hill immediately adjoining is 240 feet, and the slope 35°, hence the slope from the top of the hill to the bottom of the loch is one of 45°. The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 50	14·8 ...	40·7
50 „ 100	8·9 ...	30·9
100 „ 150	7·6 ...	26·5
Over 150	0·5 ...	1·9
	31·8	100·0

Temperature Observations.—A most interesting series of temperatures was taken in Loch Dubh at the time of the survey, as given in the first column of the following table. The loch was revisited in March, 1903, when the water was found to be uniform in temperature from surface to bottom, as given in the second column of the table—

Depth in feet.	Loch Dubh. July 12, 1902, 3 p.m.	Loch Dubh. March 28, 1903.
	° Fahr.	° Fahr.
0	59·0	41·0
10	59·0	—
16	58·9	—
20	56·0	—
25	53·7	—
35	51·5	—
50	47·1	41·0
75	44·1	41·0
100	43·6	40·9
150	43·5	40·9

The series taken in March calls for no discussion, but the series taken in July is remarkable for the low temperature of the deep water at this season of the year, and for the great range of temperature from surface to bottom. Compared with the temperatures recorded in Loch Shiel a week earlier in the same month, we find the temperature in

Loch Dubh 1°·7 lower at the bottom in 150 feet than in Loch Shiel in 420 feet, and in Loch Morar (the deepest of all Scottish lochs), ten days earlier in the same month, a temperature equal to that at the bottom of Loch Dubh was recorded only after descending to a depth of 250 feet. The extreme range of temperature shown by the series in Loch Dubh amounts to 15°·5, while the series taken in Loch Shiel shows a range of only 12°, and the series in Loch Morar shows a range of only 13° from surface to bottom. The extraordinary temperature conditions observed in Loch Dubh may probably be accounted for (1) by the great depth of the loch compared with other lochs of similar area; (2) by the small extent of its drainage area, so that very little rain-water enters the loch; and (3) by the small area of the loch and the steepness of the surrounding hills reducing the mixing effect of the wind to a minimum.

Lochs Màma and na Creige Duibhe doubtless formed at no distant date one sheet of water, which was gradually separated into two portions by the deposition of material brought down by the Allt Dearg. This is evidenced by the fact that locally the name Màma is applied to both divisions, but in this place that name is restricted to the western basin, the name na Creige Duibhe being applied to the larger and deeper eastern basin. The connecting stream is about 60 yards in length, with a depth of 7 to 8 feet, the fall from Loch na Creige Duibhe to Loch Màma being less than a foot. The tract of alluvium separating the two lochs was about 2½ feet above the water of Loch Màma, and the keeper stated that he had often seen it flooded when the lochs were high. The hills along the northern and southern shores of the lochs rise steeply up to heights exceeding 1000 feet, approaching 2000 feet along the northern shores, down the sides of which a few torrents rush after heavy rains. The two lochs trend east and west, and the outflow from Loch na Creige Duibhe passes into Loch Màma, and thence by the Gleann Màma into Loch nan Uamh.

Loch Màma (see Plate V.).—Loch Màma is over one-third of a mile in length, one-eighth of a mile in maximum breadth, and one-twelfth of a mile in mean breadth. Its waters cover an area of about 17 acres, and it drains directly an area of two-thirds of a square mile, but since it receives the outflow from Loch na Creige Duibhe its total drainage area is over 2 square miles, an area seventy times greater than that of the loch. Nearly forty soundings were taken, the maximum depth observed being 44 feet. The volume of water contained in the loch is estimated at 11 million cubic feet, and the mean depth at 14¼ feet. The loch was surveyed on July 11, 1902, and the elevation of the lake surface above the sea was determined from spot-levels as being 359 feet. It forms a simple basin, the deepest part being found towards the east end. The areas between the contour-lines, and the percentages to the total area, are as follows:—

Feet.	Acres.	Per cent.
0 to 10	8·0	46·9
10 „ 25	6·4	37·5
Over 25	2·6	15·6
	17·0	100·0

Loch na Creige Duibhe (see Plate V.).—Loch na Creige Duibhe is four-fifths of a mile in length, one-eighth of a mile in maximum breadth, and one-fourteenth of a mile in mean breadth. Its waters cover an area of about 36¼ acres, and it drains an area twenty-four times greater, or about 1½ square miles. Over seventy soundings were taken, the maximum depth recorded being 93 feet. The volume of water is estimated at 52 million cubic feet, and the mean depth at 32½ feet. The loch was surveyed on the same day as Loch Màma (July 11, 1902); the elevation of the lake surface above the sea, from spot-level and by comparison with Loch Màma, was found to be 359·7 feet. An inspection of the map shows Loch na Creige Duibhe to be (like Loch Màma) a long narrow basin of very simple conformation. It is much deeper than Loch Màma, and the deeper water approaches nearer to the west than to the east end, that is to say, nearer to the alluvial cone separating the two lochs. A similar state of matters has been noted in the case of Lochs Voil and Doine in the Forth basin, formerly a continuous loch, now divided into two portions by the deposition of material brought down by the river, where deep water approaches close to the dividing promontory of land on both sides.*

The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	21·2	58·1
25 „ 50	6·9	19·0
50 „ 75	5·1	14·1
Over 75	3·2	8·8
	36·4	100·0

Temperature Observations.—The surface temperature observed in Loch na Creige Duibhe on the date of the survey was 57°·4, in the stream between the two lochs 57°·1, and in Loch Màma 56°·5. The following serial temperatures were taken in the deepest part of Loch na Creige Duibhe at 4·45 p.m. on July 11, 1902 :—

Surface	57°·4 Fahr.
10 feet	57°·4 „
20 „	57°·4 „
30 „	53°·0 „
50 „	50°·8 „
75 „	49°·2 „
90 „	48°·8 „

* See *Geographical Journal*, vol. 15, p. 325, April, 1900.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet	Number of soundings.	Length in miles.	Breadth in miles. Max	Breadth in miles. Mean.	Mean breadth per cent. of length.	Depth. Max. Feet.	Depth. Mean Feet.	Depth. Mean per cent. of max.	Ratio of depth to length. Max.	Ratio of depth to length. Mean.	Volume in million cubic feet.	Area in square miles.	Drainage area. Total in square miles.	Drainage area. Ratio to area of loch.
Shiel	11·4	715	17·40	0·88	0·43	2·5	420	81·65	19·4	219	1125	17,215	7·56	85·42	11·30
Dilate	22·0	45	1·43	0·37	0·15	10·5	55	23·50	42·7	137	321	145	0·22	12·81	58·23
Eilt	96·4	254	3·37	0·51	0·20	5·8	119	37·12	31·2	149	479	686	0·66	12·05	18·26
Dubh	103·0	65	0·43	0·17	0·10	23·2	153	62·70	41·0	15	36	87	0·05	0·41	8·20
Na Creige Duibhe ...	359·7	74	0·80	0·13	0·07	8·7	93	32·49	34·9	45	130	52	0·06	1·46	24·33
Màma	359·0	38	0·37	0·13	0·08	21·6	44	14·29	32·5	44	137	11	0·03	2·09	69·66
		1191										18,196	8·58	99·97 *	11·65

* The drainage area of Loch Dilate is included in that of Loch Shiel, and that of Loch na Creige Duibhe in that of Loch Màma.

This series shows a constant temperature down to 20 feet, then a fall of 4°·4 between 20 and 30 feet, and a further fall of 2°·2 between 30 and 50 feet, the extreme range of temperature from surface to bottom being 8°·6.

The details regarding the lochs dealt with in this paper are collected together in the table on the opposite page for convenience of reference and comparison.

From this table it will be seen that in the six lochs under consideration nearly 1200 soundings were taken, and that the aggregate area of the water surface is over 8¼ square miles, so that the average number of soundings per square mile of surface is 139. The aggregate volume of water contained in the lochs is estimated at about 18,200 millions of cubic feet. The area drained by these lochs is nearly 100 square miles, or 11½ times the area of the lochs.

Geology of the Loch Shiel Catchment Basin.—Though the basin of Loch Shiel has not been surveyed by the Geological Survey, we understand that certain members of the staff have examined the rock cuttings on the line of railway between Loch Eil and Kinlochailort. The rocks exposed in these cuttings consist of muscovite-biotite gneiss and flaggy mica-schists, which are included in the Moine series of crystalline schists by the Geological Survey. The general strike of these strata is north-east and south-west, so that in all likelihood they are continued to the south-west along both sides of Loch Shiel. This conclusion is supported by the fact that on the lofty watershed between Loch Shiel and Loch Linnhe these muscovite-biotite gneisses have been mapped by the Geological Survey. These schists and gneisses, which are supposed to represent altered sediments, are traversed by numerous veins of pegmatite and dykes of diorite, dolerite, and basalt.

On the watershed between Glen Hurich and Glen Scaddle, on the crest of Sgor Dhomhail (2915 feet), there is a mass of foliated granite, and, further to the south-west, the later igneous intrusions of the Strontian district may enter the Loch Shiel catchment basin.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE SHIEL DISTRICT.

By JAMES MURRAY.

Of the six lochs dealt with in this paper, tow-nettings were taken in four, and a shore-netting in a fifth. The biology presented little of special interest. *Diaptomus laciniatus* was found in two of the lochs (Shiel and Eilt); these are the most southerly lochs in which this northern species was observed by the Lake Survey, though it has been recorded by Dr. Scott from one loch (Loch Doon) much farther south.

Loch Shiel.—Owing to the great abundance of *Holopedium*, which choked up the nets, it was difficult to collect other animals in any numbers. The most plentiful animals were: *Diaptomus gracilis*, *Diaptomus laciniatus*, *Cyclops strenuus*, *Bosmina obtusirostris*, *Bythotrephes*, *Polyphemus*, six species of pelagic Rotifers (including *Floscularia pelagica*) and *Dinobryon*. The plants noted were: *Xanthidium antilopeum*, *Staurastrum gracile*, and *Staurastrum braziliense*. *Lobelia* and *Littorella* were in flower at the upper end of the loch.

Loch Dilate.—As compared with Loch Shiel, the most notable features of this loch were: the greater abundance of life, the absence of *Holopedium* and *Diaptomus laciniatus*, and the presence of *Diaphanosoma brachyurum* in considerable numbers. Among the organisms observed were: *Diaptomus gracilis*, *Cyclops strenuus*, *Synchæta pectinata*, *Plæsoma truncata*, *Dinobryon*, *Peridinium*, two species of *Ceratium* (*C. hirundinella* and *C. cornutum*), *Anabæna flos aquæ* with its adherent *Vorticellæ*.

Loch Eilt.—Life was abundant, the characteristic animals being *Holopedium*, *Diaptomus laciniatus*, *Cyclops strenuus*, *Anuræa cochlearis*, *Notholca longispina*, and *Polyarthra*. *Leptodora* and *Bythotrephes* were scarce. *Bosmina obtusirostris* and a variety approaching *B. longispina* were seen. The brilliant red and blue Rotifer, *Notops pygmæus*, was plentiful. Some immature specimens of *Diaptomus* probably belonged to *D. gracilis*. On the mud in the deepest part of the loch were numbers of a pretty little green larva of an insect, enclosed in transparent flask-shaped cases.

Loch Dubh.—This little loch, remarkable for its great relative depth and temperature conditions, resembling those in a great lake, was examined on two occasions. On the first visit in July, 1902, the surface temperature was 59° Fahr., while on the second visit in March, 1903, the temperature throughout was about 41° Fahr. Notwithstanding this difference in temperature there was little difference in the animals observed on the two occasions. Those found in July were: *Diaptomus gracilis* (blue and red, grey, red, blue), *Cyclops strenuus*, *Bosmina obtusirostris* (small, purple), *Daphnia lacustris* (all pale red), *Eurycercus*, *Polyphemus*, *Triarthra*, *Polyarthra*, *Anuræa cochlearis*, *Conochilus*, *Ceratium hirundinella*, *Dinobryon*. In March all the same animals were found, except *Polyphemus*, and there were in addition a few larvæ of *Corethra* (phantom larvæ), *Notholca foliacea*, a second species of *Ceratium* (*C. cornutum*—less common in lakes), *Mallomonas*. A very small form of *Asterionella* occurred. Near the shore large spheres of *Ophridium* were found on the weeds. In the mud from the bottom were many Rhizopods of the species *Cyphoderia ampulla*, *Difflugia pyriformis*, *D. globulosa*, and *D. arcula*. *Lobelia* and *Myriophyllum* were growing along the shores.

Loch na Creige Duibhe.—As this loch was only examined by means of a net thrown out from the shore, it is probable that some of the pelagic animals may have been missed. The animals seen were: *Diaptomus gracilis* (reddish), *Cyclops strenuus* (yellow), *Alonopsis elongata*, *Chydorus sphæricus*, *Anuræa cochlearis*, *Bosmina obtusirostris*, *Arcella vulgaris*. A few of the commonest filamentous Algæ and Desmids were seen. *Asterionella* was scarce.

A JOURNEY TO LAKE SAN MARTIN, PATAGONIA.

By Captain H. L. CROSTHWAIT, R.E.

THIS journey was undertaken in connection with the demarcation of the Chile-Argentine boundary. Before, however, landing in Patagonia, we made a short trip through the channels of Tierra del Fuego on board the Argentine cruiser *Nuevo de Julio*, Captain Quiroga, which had been placed at the disposal of Sir Thomas Holdich.

The first place we touched at was New Year island, a small island situated in lat. 54° 59′ S., about 5 miles off the north coast of Staten island. Our object was to visit the magnetic and meteorological observatory established there by the Argentine Government, as a base observatory, in connection with the Antarctic Expedition, then in

FIG. 1.—MAGNETIC AND METEOROLOGICAL OBSERVATORY, NEW YEAR ISLAND.

FIG 2. BEAGLE CHANNEL.

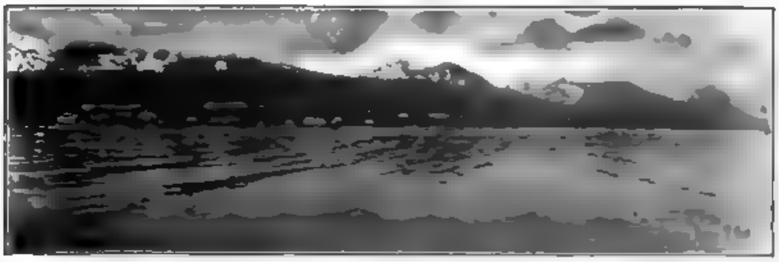


FIG 3. USHUAIA, BEAGLE CHANNEL

FIG. 4.—CAPE HORN.

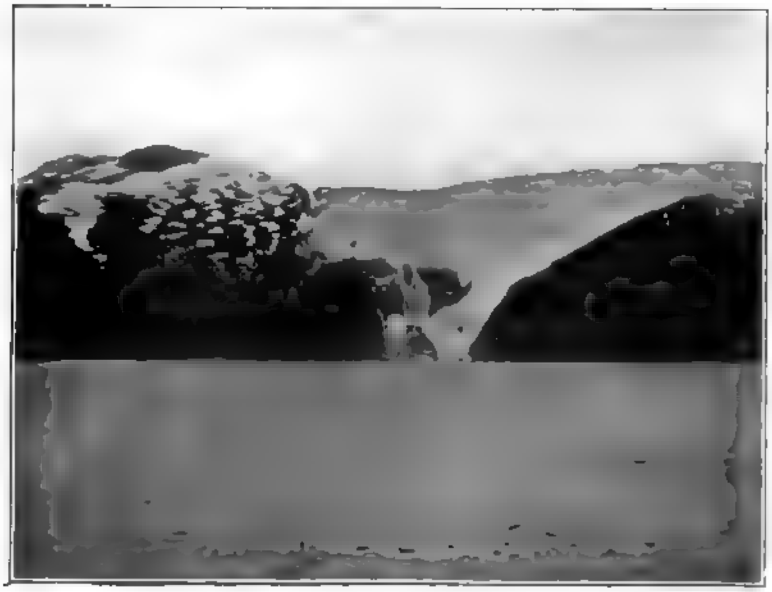


FIG. 5.—GLACIER DESCENDING TO THE SEA.

FIG. 6.—ROMANCHE BAY GLACIER, BEAGLE CHANNEL.

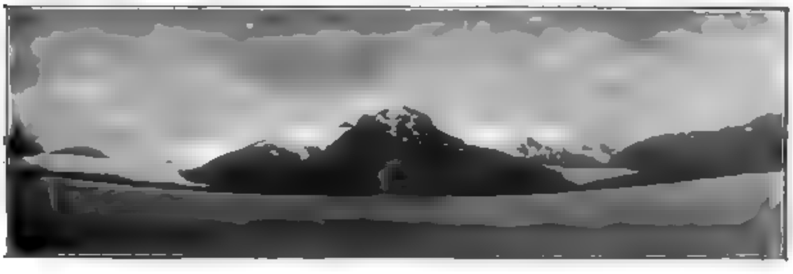


FIG. 7.—GLACIERS DESCENDING FROM MOUNT SARMIENTO.

progress under Dr. Nordenskjöld. This is a most complete observatory in every respect. It is superintended by four Argentine naval officers, who, in the interests of science, exile themselves on this lonely and desolate spot. The attention they give to their work is well illustrated by the fact that they never allow the annual range of temperature in the magnetic observatory to exceed 1° C. The following temperature conditions have been recorded on this island, as given me by the officer in charge, since the observatory was opened in February, 1902: Highest recorded, 55°·4 Fahr.; lowest, 16°·4 Fahr.; annual mean, 41° Fahr. The magnetic observatory is kept at an almost constant temperature of 64° Fahr.

Staten island was just visible through the mist. An intense gloom, beyond all description, seems to overhang this place, which makes it look like the confines of the world. Entering the Straits of Le Maire, we steamed into Beagle channel, anchoring that night off the flourishing settlement of Harberton, belonging to Messrs. Bridges, who employ on their farms a number of Ona Indians.

It is not easy to estimate the number of Indians now inhabiting Tierra del Fuego. Mr. Bridges thinks there are about 500 Onas; Mr. W. S. Barclay puts down the Yaghans at 200, and the Alacalufs at 800. This makes a total Indian population of about 1500. Formerly it was estimated at 8000 ('Encl. Brit.'), but it is difficult to believe that such a sterile land, with an inhospitable climate, could have ever supported a large population.

Continuing up Beagle channel, we reached Ushuaia. This place was established a few years ago as a naval station, and is now the seat of the Government of the Argentine portion of Tierra del Fuego. We were here, as elsewhere, most hospitably entertained by the governor.

Shortly after leaving Ushuaia we turned south through Ponsonby sound—the home of "Jemmy Button"—a very narrow channel between Naverine and Hoste islands. In the afternoon we reached Tekineka bay, where the South American Mission has a station and a church—the most southern church in the world. There live here, under the care of Mr. Williams, the missionary, about seventy Yaghan, or canoe Indians.

Leaving this damp and dreary bay, we passed False Cape Horn, and, skirting the west end of Hermite island, made straight for the Horn itself. There was little wind, but a long unpleasant swell was running. Having taken a good look at, and some photographs of, this famous but very ordinary promontory, we turned northward and anchored for the night in Goeree roads, between Naverine and Lennox islands.

The next place of interest was Sloggett bay, where gold-washing is carried on in a most primitive manner by a party of miners, mostly runaway sailors, of various nationalities. Geologically the shores of the bay appear to be formed by the upraised delta of a river, or several rivers, which once flowed into the sea here. These seem now to be

lost in a great swamp, which covers the alluvial deposit with a thick layer of peat. The sea face is a vertical cliff about 100 feet high. At the base is rock, above this the alluvial deposit, and over all a covering of peat. As the waves undermine the cliff, the gold-bearing gravel falls on the beach below. The sea, acting on the *débris* like a natural jigger, concentrates the gold a few feet below the surface. This material the miners further concentrate by washing, and thus obtain small quantities of gold—enough, it was said, to provide a living wage. So far as I know, no scientific attempt has been made to deal with this large quantity of gold-bearing material. Whether it would pay is another matter. Owing to its remote existence, and other drawbacks, probably it would not.

The most striking feature of Beagle channel is undoubtedly the astonishing number and variety of the glaciers, which occupy all the valleys descending from every mountain high enough to be covered with a mantle of perpetual snow. The general direction of these valleys is favourable as regards shelter from the summer sun. This fact, no doubt, accounts in a measure for the great extension of the glaciers. The coolness of the summer rather than the severity of the winter is also an important factor in maintaining both the glaciers and the comparatively low snow-line, which cannot be much more than 2000 feet above sea-level. It is to these features we must look in endeavouring to explain the glaciers of Tierra del Fuego.

Most of the larger glaciers we saw showed signs of shrinkage. Trees grow on the lower and older terminal moraines, the vegetation becoming younger as the actual ice - wall is approached. Lateral moraines are found stranded on the flanks of the valleys, high above the present level of the ice, and the polished rock indicates the height to which the glacier had once reached. These features were particularly noticeable in the case of the glacier opposite Romanche bay, and the large glacier descending from Mount Sarmiento. The question of the general recession of glaciers in these regions is an interesting one for future investigation, and Beagle channel forms an admirable field for study.

Navigation is not possible at night in these narrow seas. We therefore anchored every evening in some friendly cove. Often from within the shelter of these deep indentations we heard the storm raging overhead, only occasional and fitful gusts of wind reaching the ship. Now and then the crash of ice falling from neighbouring glaciers resounded among the mountains.

During our stay in Tierra del Fuego from January 15 to the 27th, 1903 (corresponding to July), the mean maximum temperature was 56°·2 Fahr., and the mean minimum 46°·7 Fahr., as recorded on board ship.

* * * * * *

Shortly after landing in Patagonia, at Puerto Consuelo in Last

FIG. 8.—BAGUALES RANGE.

FIG. 9.—BAGUALES RANGE.

FIG. 10.—CAMP NEAR TOP OF BAGUALES RANGE.

FIG. 11.—RIO SANTA CRUZ.

FIG. 12.—MOUTH OF RIO LEONA, LAKE ARGENTINA.

FIG. 13.—CLAY FORMATION, RIO LEONA.

Hope inlet, we visited the now famous Cave of the Mylodon. It is fairly well worked out as regards the larger remains of the giant sloth; there are, however, still to be found pieces of the skin with the hair on of this extinct animal. The explanation of this high state of preservation in which it is found, may be sought in the stalagmite which covers the floor of the cave. There are said to be other caves in the neighbourhood, but the few men who make a business of discovering and disposing of mylodon remains do not encourage exploration.

On February 10, 1903, I left the Chief Commissioner, Sir Thomas Holdich, at Camp Cazador, in lat. 51° S., and started for Lake San Martin. The route lies across a pass over the Baguales range. This range leaves the continental water-divide in the neighbourhood of Mount Stokes, projecting into the Pampas in a direction almost at right angles to the general line of cordilleras. The formation is basaltic, to which must be attributed its extraordinary appearance. As we entered the narrow valley leading to the pass, high pointed pinnacles and minarets towered above us, assuming all kinds of fantastic shapes and forms—some like vast cathedrals, others resembling mediæval forts. The pass, which is 4100 feet above sea-level, was just free from snow, though patches were lying about in sheltered places.

The march next day was begun in a snowstorm, and during the night the temperature had fallen to 30° Fahr. However, as we descended the weather cleared, and towards the afternoon we had a splendid view of Lake Argentino. Below us, stretching east and west, lay the great lake, about 60 miles long and 10 to 20 broad. The western end has several arms penetrating deep into the recesses of the cordilleras, and there receive the water of numerous glaciers. Large icebergs were floating on the lake, drifting with the prevailing wind towards the east. Slowly turning round, they exhibited in the glistening sunlight every gradation of colour from blue to green.

In the evening we camped on the shores of a bay. The water was covered with ducks, black-necked swans, and geese. These birds, as indeed all animals in Patagonia, are so unsophisticated from never having seen human beings, that they allow one to approach quite close without attempting to escape. I noticed this particularly with the huemul round Lake San Martin, but it seemed to be prompted by an insatiable curiosity. Under these circumstances sport, in its true sense, is impossible. Snipe were also fairly plentiful on the shores of the lake. They resemble the English variety, but fly slowly and never very far. I often found them in places high up on the hillsides, quite devoid of water.

The shores of this lake indicate every appearance of its having been much higher at no distant date, probably before the river Santa Cruz, which carries off the surplus water, had cut the deep channel it now occupies. The edge of the bay was strewn with erratic boulders deeply

scored by ice. These must have been comparatively recently transported from the glaciers of the cordilleras by icebergs and stranded on the shore.

The next march took us to the east end of the lake, where we crossed the Santa Cruz about a mile below where it leaves the lake. The current is very strong, running 7 miles an hour. Though there is plenty of water in this river, its strong stream will always debar it from being used for purposes of navigation, otherwise it would have made a splendid highway to the Atlantic.

Immediately on crossing the river we caught some armadillos. This animal is not found south of the Santa Cruz, but it is very common to the north. It is a good example of the spread of animal life being arrested by a natural feature.

The next march took us up the valley of the Rio Leona, which flows from Lake Viedma into Lake Argentino; thus the Santa Cruz carries off the drainage of these two lakes. Another march brought us to the shores of Lake Viedma. We had a splendid view, which is somewhat rare, of the whole range of the cordillera, including Mount Fitz Roy, the highest peak in this district. Its height is about 11,000 feet. Towards the top it appears to be too steep to hold snow, and looks quite bare.

An enormous glacier descends to the water's edge at the west end of the lake. It emanates from two mountains, one north and one south, in the line of the cordilleras, which are joined by a comparatively low saddle. On to this saddle the glacier descends. Tradition says it here divides in two branches, one going to Lake Viedma and the other reaching the Pacific, somewhere near Eyre sound. It is, however, unexplored, but from appearances this might be the case. If it really happens, the continental water-divide, and consequently the boundary between Chile and Argentine, would follow the surface of an ever-moving glacier. From this might result serious embarrassment where already complicated boundary questions exist.

Passing round the east end of Viedma, we crossed a low range into the valley of Lake San Martin. This lake, unlike Viedma and Argentina, has an exit into the Pacific. At the east end of the valley there is a small shallow lake called Laguna Tar. At present its waters flow into Lake San Martin, *i.e.* in a westerly direction. The continental water-divide is here so ill defined that a cutting of a few feet would cause Laguna Tar to flow to the Atlantic. There is the dry bed of a stream visible, and in time of flood this lake may, temporarily, have an exit in both directions. The continental water-divide would then run through a lake. A water-divide, therefore, without precise knowledge, may prove a very inexact definition for a boundary.

San Martin undoubtedly occupies what was once a strait joining the Atlantic and Pacific. The main body of water runs almost east and west, penetrating into the heart of the cordillera. The mountains rise abruptly from its shores. It is subject to the most violent

FIG. 14.—PATAGONIAN SCENE.

FIG. 15.—WAVES BREAKING ON SHORE OF LAKE VIEDMA.

FIG. 16.—MOUNT KOCHAIK VALLEY OF LAKE SAN MARTIN.

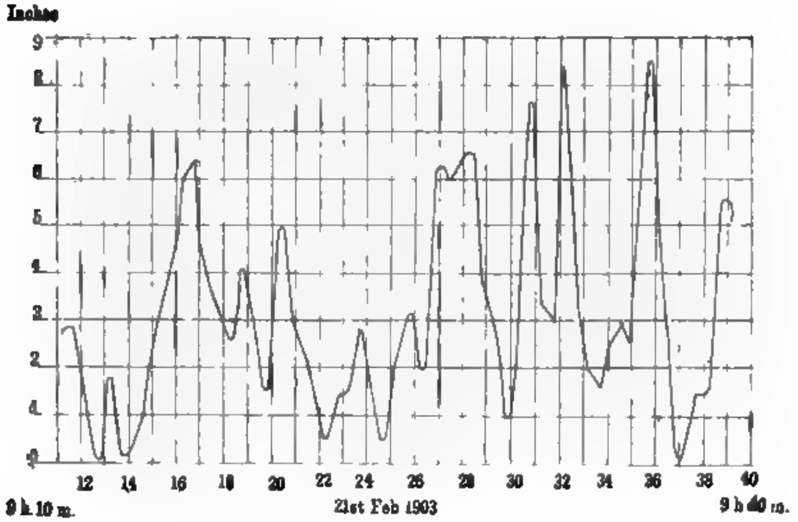
FIG. 17.—BAHIA DEL DEPOSITO.

FIG. 18.—BASALT CLIFFS, CANAL CHACABUCO.

FIG. 19.—VIEW ON LAKE SAN MARTIN.

storms, which make the lake very rough and dangerous to navigate, as I have reason to know after a week's expedition on it in a canvas boat.

While encamped on the shores of a sheltered bay, I noticed that the level of the water rose and fell in a peculiar manner. More exact measurements showed that the movements were irregular, but on an average amounted to about 5 inches, having a period of about four minutes between two successive high waters. The surface of the water to the eye was perfectly smooth. I append a diagram of these "seiches," showing 30-second observations extending over half an hour.



SEICHES ON LAKE SAN MARTIN.

The rocks round San Martin are mostly basalt. In many instances it is cellular, indicating that it had flowed under water. The geological sequence of events here would seem to have been somewhat as follows: A submerged land, when the sites of the great lakes were arms of the sea such as we now find in Tierra del Fuego; volcanic activity, when lava flowed under water, as shown by the existing cellular basalt; elevation of the land, for we find numerous instances of upraised beaches with cellular basalt overlying them; following this another period of volcanic action, and then an age of ice, for there is very marked evidence of ice-action on the basalt. In the present glaciers we have the lineal descendants of a glacial period.

In conclusion, I should like to point out that Patagonia is an excellent field for the traveller who wishes to explore unknown glaciers, and to study glacial action. It is full of interest to the geologist. The climate in summer, though cool, is extremely healthy.

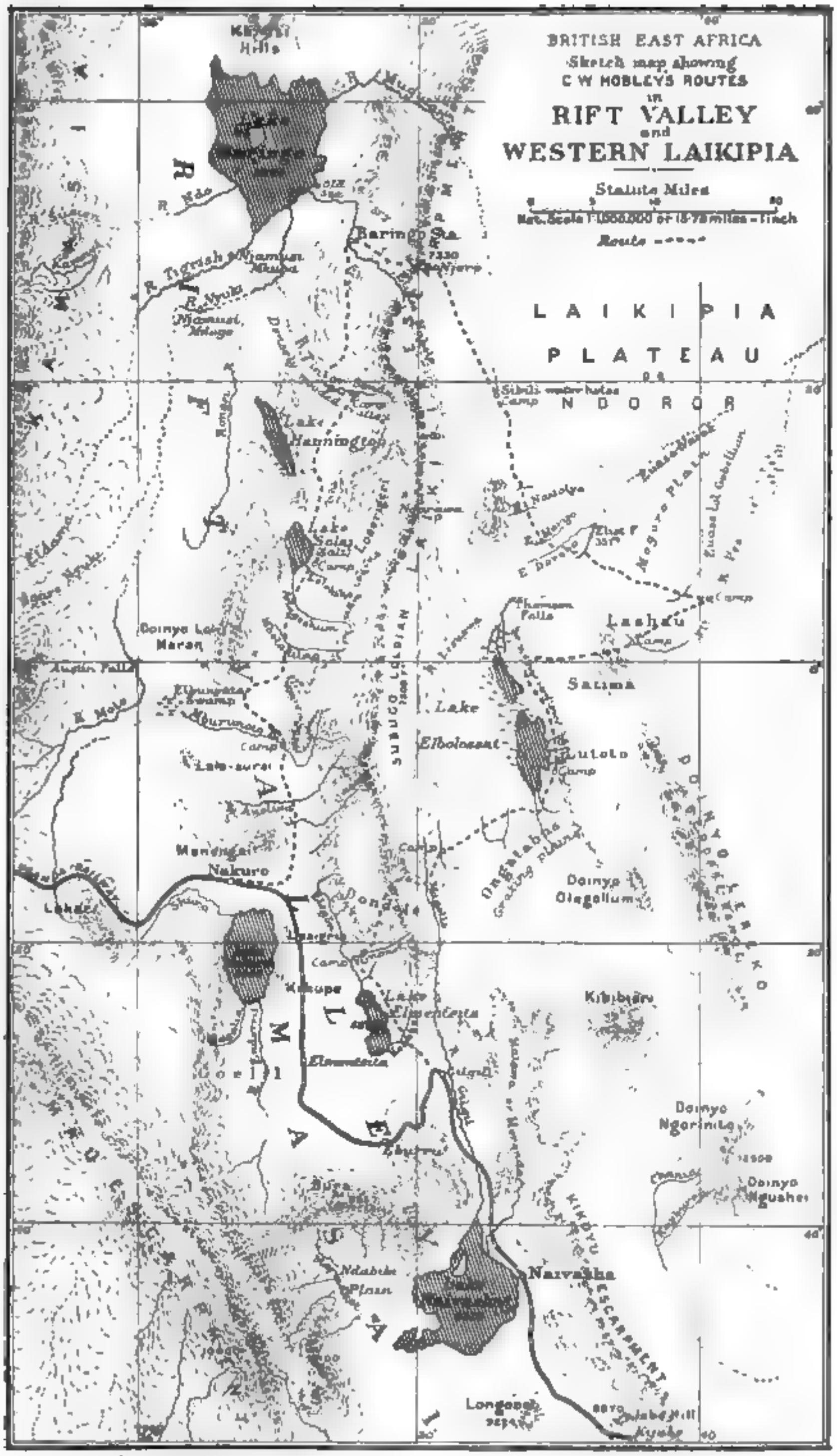
A map illustrating this journey appeared in the February (1904) number of the *Geographical Journal*, vol. 23, No. 2.

MR. C. W. HOBLEY'S RECENT JOURNEY IN EAST AFRICA.

We have been favoured by the Foreign Office with a report, by Mr. C. W. Hobley, on a journey made by him in 1904 in the rift-valley between Lakes Nakuro and Baringo and on the Laikipia uplands to the east. It is accompanied by a sketch-map (of which the accompanying small map is a reduction), drawn by Mr. Hobley to show his routes and the main features of the country traversed. The districts passed through are still far from well known, and Mr. Hobley's narrative adds many details to those supplied by previous travellers, though, as he himself remarks, the country is not even yet thoroughly explored.

Starting on July 6 from the Nakuro station on the railway, Mr. Hobley marched round the east side of the Menengai volcano and then north up the valley between it and the escarpment, several small streams being found to flow out of the escarpment and lose themselves in the plain. An enormous number of zebra were seen in the latter. A stream which loses itself in the crater of Menengai was not running at the time, but further on the Mburunoto was found to be a fine stream, and to end in the big Elbunyata swamp, not shown on existing maps. A fine Masai cattle road was struck and followed due north to the salt lake Solai, not marked on the official map. It seems, however, to be the Lake Kibibi visited by Dr. Gregory.* Three streams run into it from the south and south-east, and the Mbolakilag is said to flow in on the west. All round the lake there were delightful meadows of thick rich grass, on which numerous antelope were grazing. A tiring march through long grass and acacia woods, during which the numerous rhinoceros were a cause of danger to the caravan, brought the party to the edge of a valley 1500 feet deep, which separated the plateau over which they had been travelling from the Laikipia escarpment, here rising abruptly 3000 to 4000 feet in colossal buttresses and cliffs. Descending by a very rocky path, they found at the bottom a delightful river, 20 to 30 yards wide, called Tin by the Masai and Sondai by the Njamusi. For a time the march was continued over very broken country within the valley, along which some dense acacia forest was seen; but on seeing a large herd of elephants climbing the escarpment in a north-westerly direction, it was decided to follow their example, and after a climb of 1200 feet a broad valley was reached, with the main Laikipia escarpment on the right. A march of 16 miles due north over a waterless country then brought the caravan to the Baringo station, where Mr. Hobley spent two days, having several interviews with the Suk and Njamusi chiefs. The former people call themselves Pokot, Suk being the name given to them by the Masai.

* It is shown as Solai in Captain G. E. Smith's map in the *Journal* for September, 1899.


BRITISH EAST AFRICA
Sketch map showing
C W HOBLEY'S ROUTES
in
RIFT VALLEY
and
WESTERN LAIKIPIA
Statute Miles
Route
LAIKIPIA
PLATEAU
Baringo Sta.
Lake Hannington
Lake Elbolossat
Satima
Lutoto
Nakuro
Lake Elmenteita
Naivasha
KIKUYU ESCARPMENT
Doinyo Ngorinito
Doinyo Ngushei
Longonot
Kijabe Hill
Kibibiaru
Doinyo Olegellum
SUBUGO LOLDIAN
Laahau
Doinyo Lol Maran
Ndabibi Plain
Gorili
Eburru

The return journey was made by a route over the Laikipia uplands, and the information collected regarding these forms an interesting supplement to that obtained by Mr. Tate (*Journal*, vol. 23, p. 220 *et seq.*) and previous travellers. In a general way, it confirms the accuracy of Thomson's mapping of this region. Going west over exceedingly stony hills, Mr. Hobley reached the top of the escarpment after a steep climb of nearly 3000 feet, being rewarded by a wonderful panorama of the rift-valley and Kamasia escarpment. Looking east, the country was a boundless green rolling plain, gradually sloping east, and with belts of thick forest in every valley. To the north the tabular mass of Loroghi was a striking object. The march led in a south-south-east direction, a way having often to be made through thick wet grass. Various swampy streams drain towards the Euaso (Guaso) Narok, which, where crossed, was a fine stream 20 to 30 yards wide. About a mile below there were falls 40 feet high, which Mr. Hobley names the Eliot falls. (The Thomson falls are higher up on the same river.) The most easterly camp was on the Pes river and swamp (Bes of Thomson, Pesi of Tate), one of a series of streams rising on the north-east and east of the Aberdare range. At Pes swamp some very interesting colonies of Wandorobo hunters were met with: a communication on these curious people will be found in the next number of the periodical *Man*. Hence the route led nearly west over open downs with beautiful belts of young juniper forest in the valleys. It brought the caravan to the edge of the escarpment overlooking the Elbollossat lakes, the outlines of which Mr. Hobley for the first time defined with some accuracy. They lie north and south of each other (not east and west as was shown on Mr. Mackinder's map), and are only separated by a strip of swamp. In descending the escarpment to the eastern shore, some wonderful graded roads were met with, thought by the Masai to have been made by elephants, but more probably the work of human hands. The southern edge of the water was skirted, and after 6 miles the western side of the miniature rift-valley which contains the lakes was climbed, the route being continued (in part through thick fog) over the grassy downs of Subugo Loldian * and down the escarpment to the neighbourhood of Elmenteita.

It will be noticed that Mr. Hobley's map gives an entirely new set of names to the chief orographical features of the Laikipia region, the nomenclature of which is one of the most puzzling questions in the geography of this part of Africa. In view of the multitudinous names in use among the various tribes of the surrounding country, it may be doubted whether any one set can justly claim the sole title to correctness; but Mr. Hobley's long experience of the Masai and other tribes

* Or, more properly, Osupuko Lultian. The word Subugo means highlands with patches of forest. It occurs also in the Subugu La Poron, applied by Thomson to a part of the Aberdare range.

lends a special weight to the names assigned by him. The Aberdare range is named by him Doinyo (Donyo) Lereko, Satima being applied to the northern extremity only. The Kinangop of Thomson, von Höhnel, and Captain (now Lieut.-Colonel) G. E. Smith, called also Donyu Ronyu by the last named, and Nandarua by Mackinder, he calls Doinyo Ngushei,* a neighbouring peak to the north being marked as Doinyo Ngorinito. Mr. Hobley's Kibibieri is evidently the Gojito of Thomson, which was thought by Gregory to have no existence except as part of the Satima range. It is also the lesser Satima of Smith, and its height should therefore be 11,174 feet, in accordance with the observations of that officer (*Journal*, vol. 14, p. 289), instead of the 13,390 of Col. J. R. L. Macdonald's map issued by the Intelligence Division of the War Office, this being the height of the main Satima in the Aberdare range. Mr. Hobley's Doinyo Olegollum,† a little further north, does not seem to be represented in previous maps.

THE EXPEDITION TO WESTERN TIBET.

INFORMATION has reached the Royal Geographical Society as to the main results of the expedition which Sir Frank Younghusband sent westwards to establish a trading centre at Gartok, in Western Tibet. This expedition was under the command of Captain Rawling, who was accompanied by the able and experienced surveyor, Captain Ryder, R.E., as also by Captain H. Wood, R.E., and Lieut. Bailey. Though the party had hardly any escort, it was received everywhere with open arms. The amount of new geographical work accomplished by this western expedition renders it of the first importance, and is some compensation for the stoppage of the expedition which was all ready to start down the Brahmaputra to solve the old Sanpo problem, but which, for some unexplained reason, was stopped.

Fortunately, during the progress of the expedition to Lhasa, Captain Ryder, who was in charge of the survey, was able to map all the country round the Khambajong camp. Fine views were obtained of the snows from Chumalari, past Kanchenjanga, to Mount Everest. One range running north, apparently from Mount Everest, and which, from the apparent height of some of its peaks, had excited interest in the camp, was found by triangulation to have no great height, 22,000 feet or so, and the two peaks north-west of camp, which one of the native explorers had mentioned, only proved to be 21,000 feet in height.

The Chumbi valley, which is narrow, did not take long to survey, but a portion of unexplored Bhutan was done by sending a native

* The altitude marked on our map belongs to this peak, and not to the Doinyo Ngorinito.

† Doinyo Olegollum is not a separate mountain, but is more in the nature of a bulge on the west face of the Aberdare range; it is shown in rather too pronounced a manner on the map.—C. W. H.

surveyor down the valley to the plains and back again. The mission then moved forward to Tuna, and later to Gyantse, the country around which was mapped. On the advance to Lhasa, in the Karoda, on either side some fine snow-peaks 23,000 feet or so, was seen a portion of the Yamdok Tso, the obvious old outlet of which was passed at Yarsik, but a small stream now flows in there, and not out of the lake. Military considerations prevented any surveying further than some 30 miles up the valley from Lhasa, but Captain Ryder and Captain Cowie made a good accurate map of Lhasa itself and its suburbs. The party under Captain Rawling had a most interesting journey westwards; they had two and a half months of continuous marching and surveying.

Briefly, the results of the journey, geographically, are that Captain Ryder and Captain Wood have surveyed the Brahmaputra from Shigatse to its source, the Sutlej from its source to British territory, and the Gartok branch of the Indus; they have also surveyed the Mansarowar and Rakas Tal lakes, proving that while there is an outflow from the former to the latter during four months of the year, during the rains and the melting of the snows, there is now no outlet from the Rakas Tal, although the Tibetans declare there used to be. This moves the sources of the Sutlej far west of what they have generally been considered to be. They also fixed many snow-peaks, and although the computations have not been worked out, it seems clear that no peak exists anywhere approaching Mount Everest in height.

CAPTAIN OWEN'S MAP OF UNYORO.*

By the courtesy of the Foreign Office, we are enabled to publish, in the present number, a sketch-map of the country between the Albert Nyanza on the west, and the Victoria Nile on the east and north, made during 1900–1901 by Captain R. C. R. Owen. It was compiled during tours of inspection carried out by Captain Owen whilst serving as Officer Commanding the Unyoro military district under the Foreign Office. The route-traverse was carried out with prismatic compass and cavalry sketching-board, distances being obtained by pacing, with the control supplied by intersection. The routes shown are those actually paced, but the country on either side was frequently examined for some distance. No attempt has been made to introduce detail from other surveys, or to adjust the work so as to fit it with that of previous travellers, except in so far as the whole has been adjusted to one or two positions determined astronomically, especially those of the late Lieut.-Colonel Vandeleur, whose work still supplies the best general basis for the map of this region. The map was sent home by the Director of Intelligence in Egypt, through Lord Cromer, and it is stated that sickness and press of work are responsible for the delay in its completion.

* Map, p. 352.

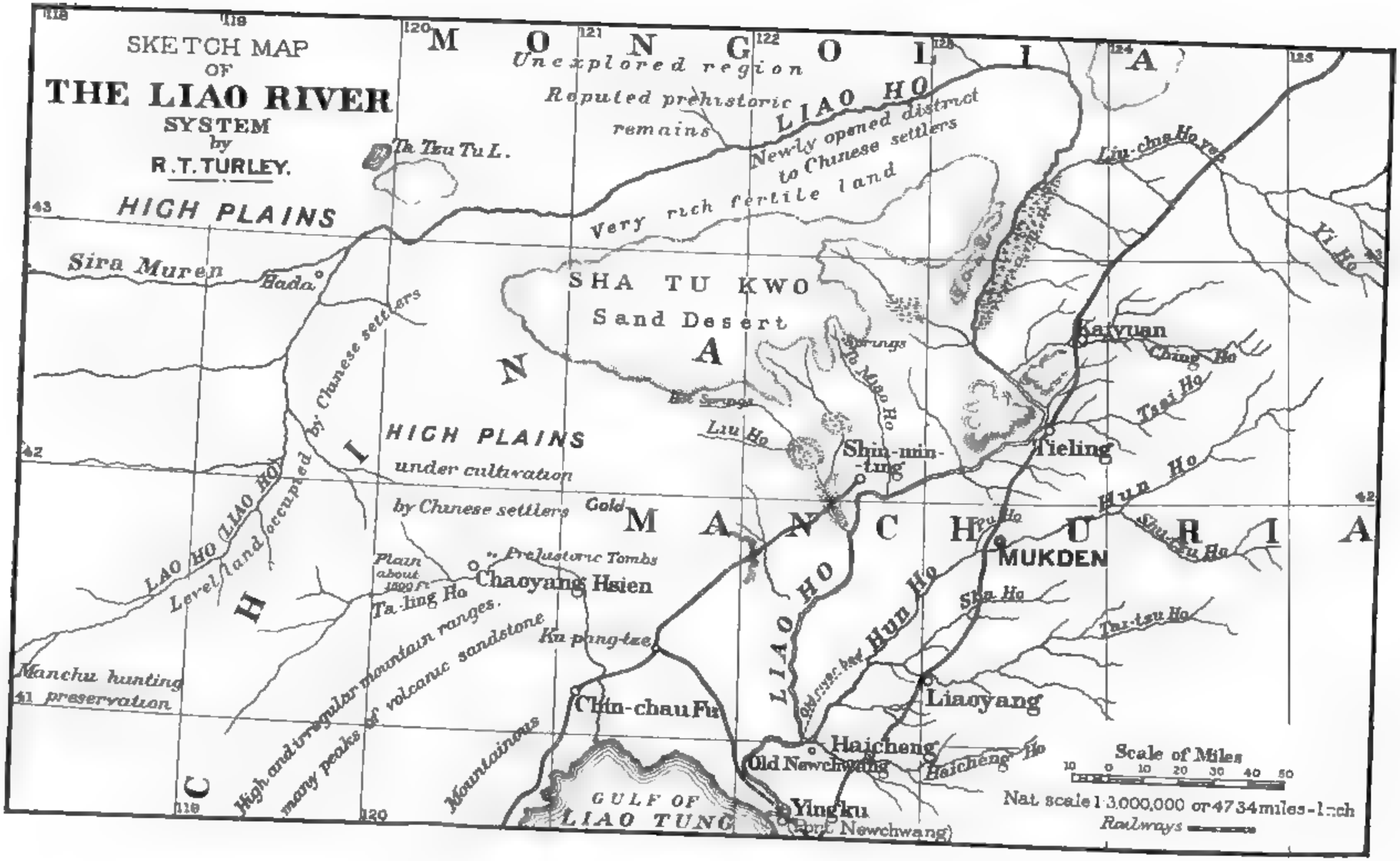
SOME NOTES ON THE RIVER SYSTEM OF THE UPPER LIAO, MANCHURIA.

By ROBERT T. TURLEY.

THOUGH Manchuria has for many years been expected to become of great political importance, but little of a definite nature is known of its geography. Thus, a few general remarks on the Liao river may be of interest.

The main stream rises far away in Mongolia—or rather in a section which is virtually China, and just near the old town of Jehol, north-east of Peking—and thence, running north by east, enters Manchuria nearly on the 44th parallel of latitude, westward of the city of Chang-chiin-Fu, or Kuau-cheng-tzu. Both the source and mouth are almost on the 41st parallel, and thus its course actually describes a peculiarly elongated horseshoe shape. From the mountains and hunting forests near Jehol it receives much water, which it loses, to a somewhat large extent, as it wends its way slowly over the plateau. It passes through a region which until recent years was given up to nomads, but now thousands of industrious Chinese are turning the desert or wilderness into rich corn-lands for a good distance on either side of the river. Until it enters Manchuria—near the once Mongolian trading centre, now Chinese town of Cheng Chia-Tun—it passes only one town, Hada, a noted barter-market. One would venture to suggest that some explorer, experienced in Central Asian geography, should, making Hada a base, investigate the whole of Eastern Mongolia. Our knowledge is vague and uncertain, and such as we have has been gained from casual wanderers—often with but little practical experience, and mutually contradictory on important points. For example, one will describe mountains in a given district, and another will report only low hills. It will probably be found that both are partly right; thus, a traveller by rail from Shan-hai-Kwan to Newchwang would speak of mountains rising to the northwards, whilst another, journeying on the far side, across the high-altitude plains, will refer to the same as low hills, as seen from a distance and looking southwards. The same with rivers. East and west of the upper Liao are some curious phenomena. At certain places, rivers, quite wide and deep, are found in the early autumn which in the spring can scarcely be traced over the sandy wastes. Others may flow continuously to a certain point and then become extinct, absorbed in the sandy soil. Once, when travelling with a companion on the borders of the lesser Mongolian desert, which is east of the Liao, being winter, and a certain river unexpectedly in view, all frozen, we began to argue as to where it might flow, whether east or west; finally an old Mongolian came near, and we both appealed to him. He smiled knowingly, and said, "You are both wrong; it goes nowhere." "Explain yourself," we said. "It just runs a bit south, and then spreads out and is eaten by the sandy soil." "How about the rainy period?" we asked. "Then," said he, "further south there does arise from the ground much water, which flows as a sandy and treacherous river into the Liao below Hsin-min-ting." On another occasion we met a traveller who urged us not to advance, as a river, which we should reach at sundown, would be unfordable. We, however, pressed on, and found that what had been a deep current a few hours previously, which our friend, with great trouble, had only just managed to ford, was but a shallow stream. On further investigation, we discovered that some strong intermittent springs poured their waters at fairly regular intervals down this river-bed, and thus the natives called it a tidal river. Its name is the Ta-miao-ho, and can be found to the east of the town of Ku-Lor.

The geologist would find much to interest in the curious rock-formations of the


SKETCH MAP
OF
THE LIAO RIVER
SYSTEM
by
R.T.TURLEY.
MONGOLIA
Unexplored region
Reputed prehistoric remains
LIAO HO
Newly opened district to Chinese settlers
Very rich fertile land
Ta Tzu Tu L.
HIGH PLAINS
Sira Muren
Hada
SHA TU KWO
Sand Desert
Springs
Hot Springs
Liu Ho
Shin-min-tung
Kaiyuan
Ching Ho
Tsai Ho
Tieling
Hun Ho
Yi Ho
MANCHURIA
MUKDEN
Sha Ho
Tai-tzu Ho
Liaoyang
Haicheng
Haicheng Ho
Old Newchwang
Yingku
(Port Newchwang)
GULF OF
LIAO TUNG
Chin-chau Fu
Ku-pang-tze
Chaoyang Hsien
Prehistoric Tombs
Gold
HIGH PLAINS
under cultivation
by Chinese settlers
CHINA
Level land occupied by Chinese settlers
LAO HO (LIAO HO)
Manchu hunting preservation
High and irregular mountain ranges.
many peaks of volcanic sandstone
Mountainous
Plain about 1800 ft.
Ta-ling Ho
Scale of Miles
Nat. scale 1:3,000,000 or 47.34 miles-1 inch
Railways

hills—where such occur—especially the various lava-beds laid bare here and there, and volcanic sandstone in which sea-shells and water-plants can be traced by their markings; and in many a watercourse pieces of fossil wood, white and glistening, may be picked up. Whether or not the archæologist would be rewarded, one can hardly say, but I am inclined to think that buried remains of a bygone race may be found. Near Chao Yang there were some curious cists and non-Mongolic tombs, and one has a theory that a highly civilized race, from whom conquering hordes gradually emerged and swept down towards Southern Asia and Europe, once peopled this region.

The Chinese colonist of Shantung and Chih-li, whose very instinct is to destroy all trees and brushwood, finds that, once the Mongols cease to burn the steppes and when these are brought under the plough, trees will flourish. A few feet beneath the surface of the soil much moisture exists, and so willows and cotton-wood branches are planted very deeply, and these, in a few years, become fine groves of trees, which modify the air and act as a break to the terrible winds, which in springtime would, otherwise, blow the seed-grain out of the ground. Owing to the wasteful habits of the nomads, the sandy deserts have rapidly encroached on once fertile lands.

The most northern bend of the Liao river, which is formed by the junction of the Lao Ho (Khe) and Sira-muren (or upper Liao), is fully 100 miles due north of the position allotted to it on most maps, which follow the error of the cursory survey of the famous Jesuit fathers in the reign of the Emperor Kang-hsi. About lat. 43° 50′ and long. 123° 40′ the river turns almost due south, and from this bend to the sea might be made navigable for the ordinary river traffic if taken in hand at least for a few months of each year. The Government allows, however, no boats to pass above the customs station at Tung-chiang-tzu, a large emporium 100 miles further south, and near the town of Tieling, which, as a military centre, controls the river.

The first tributary in Manchuria to bring any amount of water is the Liu-ho-Yen river, which drains a considerable area between Kaiyuan and Kwan-cheng-tzu, and which is bisected by the Russian railway. Then above Tieling, about 30 miles, there is the Ching Shui Ho, and just north of Tieling the Tsai Ho, both spanned by fine railway bridges, but generally fordable for ordinary traffic, excepting at or immediately after the summer rains. From Tieling to within 90 miles, in a direct line, from the sea at San-cha-Ho, where the Hun enters the Liao, there are but small streams. San-cha-Ho is the tidal limit, and from here to Newchwang the water is always more or less muddy, though clear above this point.

The Hun is navigable for small junks from Chang Tan, a place 30 miles below Mukden. In the vicinity of this city the Hun is wide and shallow, with sandy wastes and a shifting bed. Above Mukden it is used only for down-stream rafts. The scenery is grand above Mukden, and the Fu-shun valley is especially beautiful, the scenery commencing with the famous Manchu tomb-hills and forests of the Fu-ling, where No-ar-chu, grandfather of the first Manchu emperor, sleeps.

Thirty miles west of Liaoyang the Tai-Tzu joins the Hun at Hsiao-Pei-ho, and is navigable for shallow-draught boats only to Liaoyang city. Fifteen miles west of Liaoyang the Sha-ho enters the Tai-Tzu, and is an insignificant and sluggish stream which flows, from below the railway bridge of Sha-ho-pu, between high banks, very steep, and in a narrow and boggy bed. Above the bridge there is an open and deep sandy bed, with a, usually, small stream meandering over it.

The Liao has not a single bridge of any description, and is crossed on the ice in winter, or by ferries during the open season. In its remote upper reaches it is fordable. The fish are poor in quality, few species, and small in numbers, excepting the semi-salt water varieties near the port of Newchwang.

THE MAP.—The map has been compiled as follows: The sources of the Liao—or Lao Ho (Khe)—from inquiries made by myself when travelling in south-eastern Mongolia, especially from data supplied by the Rev. John Parker (London Missionary Society), who worked the whole region. Later I sent a fairly well-trained native to gather all the information he could, and I depended on him for the section from Hada to the northernmost point. The Sira Muren is inserted from Russian sources, which are not quite reliable. From the most northern point to the mouth the river has been, on the whole, carefully sketched by myself; a few main places were fixed for latitude and longitude, etc. (the latitude is the more correct), and other details from compass-bearings. I am very familiar with the whole of the river and its tributaries from the northernmost bend to the sea. I have been much about the Eastern desert and the curious disappearing rivers.

THE MAJOR NATURAL REGIONS: AN ESSAY IN SYSTEMATIC GEOGRAPHY.*

By A. J. HERBERTSON, M.A., Ph.D.

THOSE of us who teach geography in the Universities have constantly to answer the question, What is geography? and in preparing our work we have to be quite clear about its content and scope. In this country we are less tied by tradition than in some others, for there is practically no systematic geography to bind us. In Germany the Ritter and Humboldt traditions gave rise to two schools. To America the Ritter tradition was carried over by Guyot, but a new one developed by geologists has superseded it. For long in our country geographical progress meant exploration, mainly with a commercial or political bias, and descriptive and statistical geography was taught. It was only with the rise of an academic geography that the wider conception of geography as the science of distributions developed.

In studying distributions comparisons were inevitable between geology and orography, climate and vegetation, and so on, and we were led to think that there might exist definite natural divisions of our globe. This resulted in an attempt to replace the purely political divisions of the world by others based on configuration. At this stage both the teaching and text-books gave a rational analysis of the main-feature lines as a guide to the general build of the continents, and this was supplemented by a consideration of the climatic and biological elements also for the continents. In the detailed study of each continent, however, the descriptions were applied to the various political divisions. This is found to be unsatisfactory. Why should Southern Canada be treated separately from the Northern United States? Such separation involves much waste of time, which would be obviated by a more rational subdivision of North America.

How are we to go about making the more rational subdivisions? At the outset two difficulties present themselves: (1) What characteristics should be selected to distinguish one region from another? Size is not a sufficient guide, although it must not be neglected; neither is structure, nor even configuration, although this last suggests many important divisions of the Earth's surface, which must be taken into account in any rational classification. (2) How can we determine the different orders of natural regions? The British Isles, for instance, form part of

* Research Department, February 29, 1904.

a much larger natural area, that of North-Western Europe, while they themselves can be analyzed into a number of sub-regions.

The recognition of geographical forms has gradually been taking place. It has necessarily been late in the history of thought, first, because our knowledge of the surface of the globe was insufficient until the explorations of the nineteenth century had traced its fundamental features; and, second, because the specialist interpretation of the accumulated data was a necessary preliminary to its utilization for systematic geography.

The evolutionary ideas of the latter part of the eighteenth century were applied to biological and human affairs in the nineteenth, and the fascinating work of examining natural objects in their light absorbed the energies of the best workers. All were forced to consider environment, and even its evolution. If Humboldt's *Cosmos* had no immediate successor, this was inevitable, as a period of intense analytical specialization was a necessary preliminary to the more complete synthesis, of which we now see the beginnings in all departments of thought. Speaking generally, this synthetic work must have been carried far enough to permit of at least rough mapping before the geographer can begin his part of the task. In Berghaus's 'Physical Atlas,' and for meteorology in Bartholomew's volume, we have the raw material for systematic geography as far as concerns the major forms. These maps, however, unless it be in the case of configuration, are not drawn from the geographical point of view, but from those of the various specialists who have edited the volumes.

In what way is the geographer to use this raw material in working out a systematic geography? This involves the question, what is the subject-matter of geography? This I take to be the study of phenomena from the point of view of their distribution on the surface of the Earth, in natural groups, and not as isolated phenomena.

Geography is not concerned with distribution of one element on the Earth's surface, but with all. If geographers first regard the distribution of different phenomena separately, it is only in order to help them later to consider them together more effectively. This is not to say that all these different distributions are of equal importance, but that all must be taken into consideration before the problem of systematic geography is solved. Some may bulk more largely in the geographical consciousness than others, but all must be kept in view. Configuration is necessarily the framework, but we must not think of it merely as a more or less irregular surface; we must see it as part of a solid which comprises not merely the soil beneath, but the air above, with relations to other parts of the Earth, and also to the influences coming from outside the Earth. This gives a movement, a life to the whole, and it seems to me useful and not altogether fanciful to speak of this geographically discerned complex as a macro-organism.

A recognition of more complex units than the individual has gradually taken place, and has grown more familiar in our own country in recent years with the rise of such studies as those of plant associations, or in practical life with the development of local self-government. One may not have the exact equivalent of the biological species and genera, but it is useful to remember the existence of these, which suggest different orders of geographical divisions.

The systematic botanist or geologist has no difficulty in defining the objects of his investigation, although he may have many about their classification. The systematic geographer has first to point out what he wishes to systematize. This I believe to be definite areas of the surface of the Earth considered as a whole, not the configuration alone, but the complex of land, water, air, plant, animal, and man, regarded in their special relationship as together constituting a definite

characteristic portion of the Earth's surface. The question is, what are the characteristic and distinguishing elements of the areas which we may term natural regions?

While we may not be able to dissect our natural region or terrestrial macro-organism into the organs, tissues, and cells of the vital organism, we can find in this idea a useful hint. We may see in such a paper as that by Prof. W. M. Davis on the "Drainage of Cuestas," the beginning of monographs on the tissues of the Earth's surface. These will deal, however, not merely with the mutual adjustments of drainage and land forms, but also with the well-marked zones of climate, vegetation, and even human distributions which characterize such forms when situated in similar climatic areas.

The recognition of the possibility of dividing the lands into great natural regions I have found so useful both in investigations and in teaching, that I venture to bring it before you. I think it should prove a stimulus to geography, similar to that derived from the development of a natural systematic botany or zoology. This paper does not profess to present a complete solution, which cannot be arrived at in the existing state of our knowledge, but is intended to initiate a discussion on—

(*a*) The desirability of developing such a systematic geography.

(*b*) The major units with which that systematic geography would deal.

It is essential, first of all, to pass in review the areas determined by the distribution of one or other class of phenomena, before discussing the natural regions which can be outlined from a consideration of the distribution of all classes. The facts of configuration and of climate are of first importance, but the distribution of vegetation, and even of man, may also profitably be examined.

Configuration.

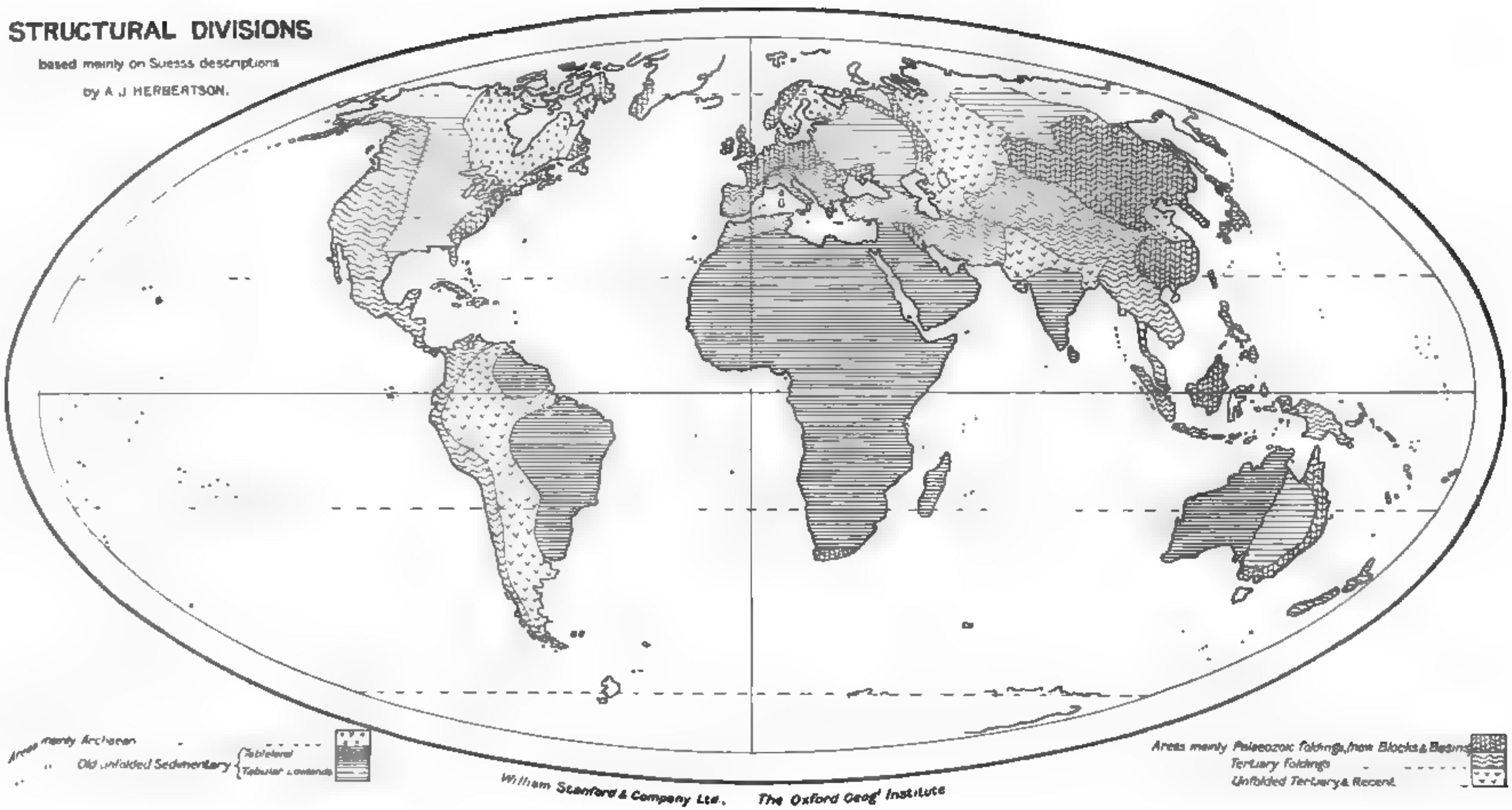
Two facts have to be considered—first, extension horizontally and vertically; second, the surface form, which is determined by structure, the nature of the transforming processes, and the time during which they have been active.

It is hardly necessary to refer to the vertical distribution of land. The 600, 3000, and 6000 feet (or 200, 1000, and 2000 metre) lines are perhaps the most valuable. Special terms for those different zones of height would be useful, but are difficult to select from our ordinary vocabulary; lowland, upland, highland are the least unsatisfactory for the three lower zones. Perhaps, following Wagner, "culminating land" or else lofty or upper mountain zone might be used for regions over 6000 feet (or 2000 metres).

This culminating land, above the 6000-feet line, is almost confined to a Pacific belt bordering that ocean, to a Mid-World belt from the East Indies to Iberia, to Greenland, and to eastern Africa. The lowlands are found mainly on the continental side of the Pacific lofty belt, and on both sides, but more particularly on the Arctic side, of the Mid-World belt.

The feature lines of both the high and low lands are varied, and depend in the first place on the structure of the crust. The accompanying morphological map is based mainly on Suess's classical work.

(1) The Pacific and Mid-World belts of lofty land coincide with the areas where the rocks of *all* ages have been folded into parallel ridge and furrow—*the young folded mountains*. The continuity is modified here and there by great lava, flows and volcanic cones, or by raising or lowering of great blocks as a whole. The general features are all drawn out in the direction of the belts, which we might describe as the crests of major waves, of complex undulating character, bordered by



STRUCTURAL DIVISIONS
based mainly on Suess's descriptions
by A. J. HERBERTSON.
Areas mainly Archaean
" Old unfolded Sedimentary { Tableland / Tabular Lowlands
Areas mainly Palaeozoic foldings, now Blocks & Basins
Tertiary foldings
Unfolded Tertiary & Recent
William Stanford & Company Ltd., The Oxford Geog^l Institute

two major troughs, the one deeper than the other. *Cf.* the Chilean deeps and the Paraguay plains.

(2) The intermediate heights are of two types. In both there are raised blocks bordered by sunken areas, the chief margins being determined by fractures, while the drainage systems are of great importance in shaping the superficial features. In one type the palæozoic rocks are folded, but not the younger ones. These we may term *denudation highlands*, because the main feature lines other than those determined by fractures are due to superficial erosion, which may, as in the Appalachians, or may not, as in the Central European Highlands, bring out very clearly the lines of crustal folding. The parallelism of ridge and furrow is on the whole rarely well marked. Young volcanic rocks are found along the marginal fractures both in this and in the next type.

(3) In the other type, even the oldest sedimentary rocks lie almost horizontally, with flexures only here and there, and form vast *tablelands*. The feature lines of these tablelands, where not determined by fracture, are river-valleys, which as a rule are steep-sided gorges—at least in the early phase of denudation.

(4) The *lowlands* consist of reduced forms of types 2 and 3, and, in addition, areas covered with recent deposits either of terrestrial or marine origin. These we distinguish as *denudation plains, tabular plains or platforms, and accumulation plains.*

The study of these types—young folded mountains, tablelands and platforms, denudation highlands and plains, and elevated and lower accumulation lands—suffices to give an idea of the main feature-lines of the lands of the globe. There is a very large number of varieties, partly due to the relative importance of fracturing and folding in a given area, partly to the nature of the transforming agents at work—ice, running water, or dry air. To the distribution of these processes the rainfall map is a key, and for the secondary division of land forms, a superposition of the orographical, tectonic, and rainfall maps is necessary. The rainfall map is important in other connections, and this leads to the consideration of the distribution of climatic forms.

Climate.

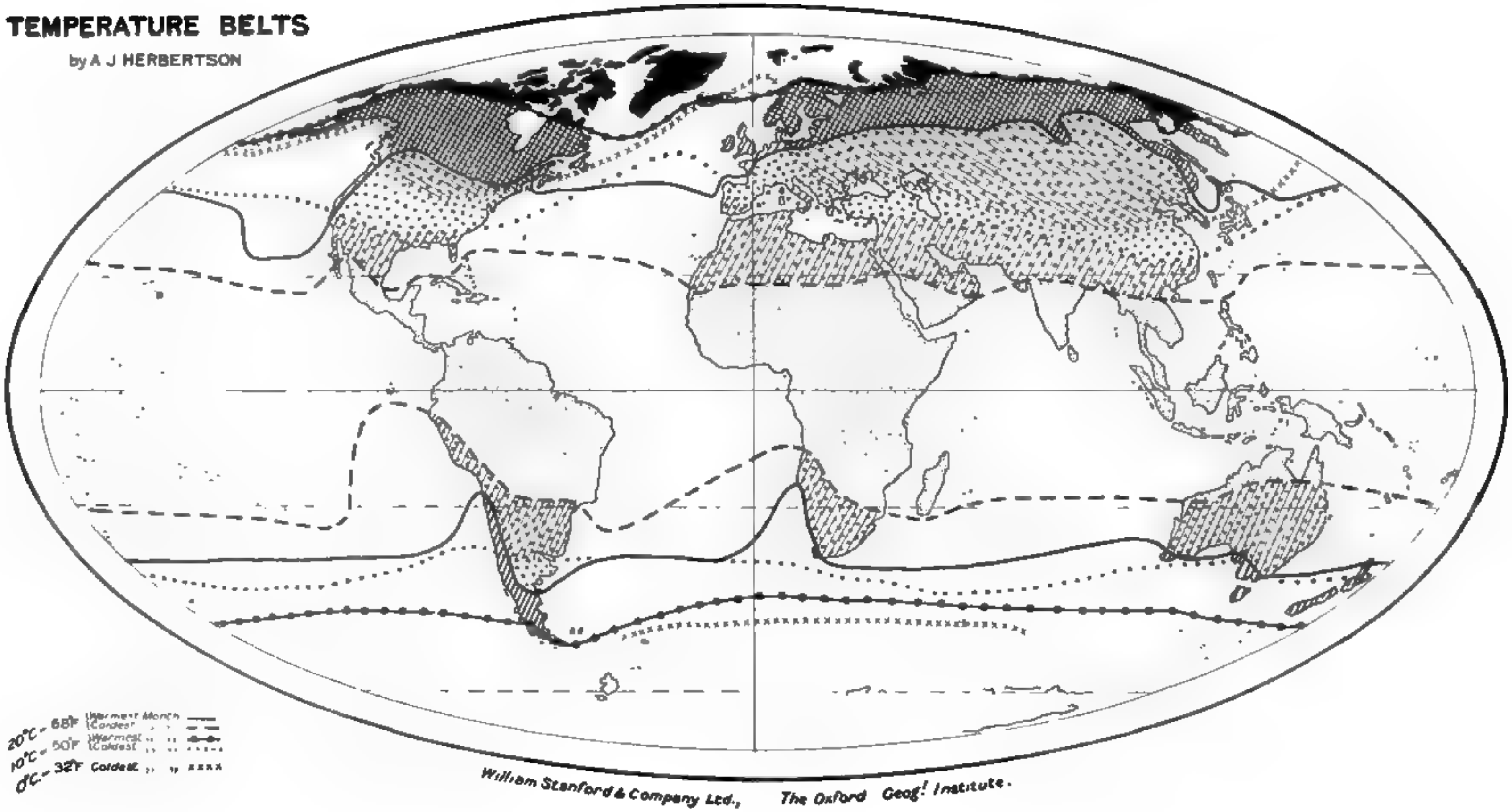
While the pressure and wind map is the key to many climatic peculiarities, for our present purpose the temperature and rainfall maps are of the greatest importance.

The isotherms available of most geographical importance are those of 32°, 50°, and 68° Fahr. (0°, 10°, and 20° C.) in the coldest, and 50° and 68° Fahr. (10° and 20° C.) for the warmest months, that for 50° Fahr. (10° C.) in the warmest month being perhaps the most significant. They indicate the succession of temperature belts, each with its own characteristics. These belts, as the map shows, are, owing to winds and ocean currents, narrowest in low latitudes in the west, and in the higher latitudes in the east of the continents. In these narrow parts the temperature conditions vary most within unit horizontal distance, whereas on the opposite sides of the continents they vary least. There is a contrast between the temperature conditions of east and west. This is part of the general climatic difference between east and west, which is of fundamental importance.

Rainfall maps are of even greater significance. The rainy season, as well as the quantity of rain, must be taken into account. A new map showing seasonal rainfall, based on Supan's seasonal rainfall maps, accompanies this paper. This permits the differentiation of regions which receive sufficient rainfall at none or one or more seasons, and the comparison between those regions where the rainfall is precipitated when temperature conditions are most and least favourable.

TEMPERATURE BELTS

by A J HERBERTSON



The first contrast is between the drier interior and the wetter coast; the second, between the drier lowland and wetter highland; the third, between the east and west coasts. On the east coast most coastal lands receive a fair supply of rain from equator to polar circles, but in the west, dry areas extend from the coast far inland around each tropic on the lee side of the lands in the trade wind belts. The temperate coastal lands receive most rain in winter, but nearly all other parts of the world receive most in summer. The northward and southward movement of the wind-belts determines areas on each side of the tropical deserts—the equatorial one with a summer rainy season, the polar one with a winter rainy season.

Combining these, we have the following climatic regions:—

(1) Polar, where the temperature is never high and the rainfall always low, most falling in the summer.

(2) The cool temperate belt, with (*a*) a rainy west coast; and (*b*) a less rainy east coast—both with rain at all seasons, the maximum falling in autumn or winter; and (*c*) an internal area of great extremes of temperature, and a low and early summer rainfall.

(3) The warm temperate belt, with (*a*) winter rains in the west; and (*b*) summer rains in the east. (*c*) The intermediate internal region, where it occurs, is one of great extremes of temperature and low rainfall, especially where mountainous.

(4) The western tropical deserts, with great ranges of temperature, and little cr no rainfall.

(5) The inter-tropical regions, with one rainy season in summer.

(6) The equatorial rainy areas, with two relatively drier periods.

The mountain areas partly help to define the limits of these regions, and partly introduce zones with successively colder climates and, up to a certain level, with wetter ones.

It will be seen from the map that most of these regions occur two or three times in each zone, and accordingly give the data for valuable comparisons.

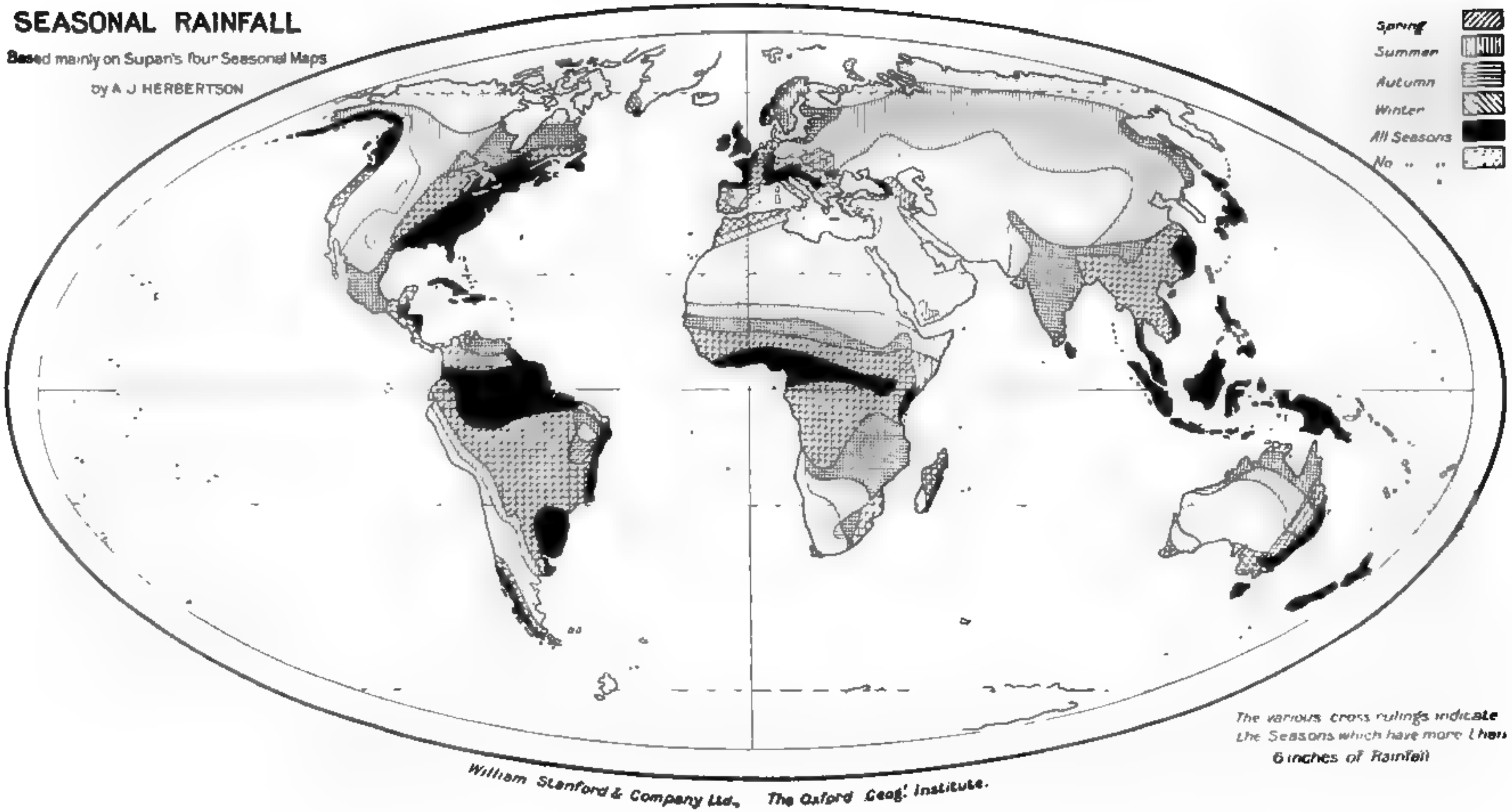
Vegetation.

In its main outlines the vegetation map follows the climate map, and only in its secondary characteristics does it show the effects of the soil and drainage. If the existing plant-covering of the Earth is mapped, then the influence of man is a third factor, which in most botanic maps is eliminated. The vegetation map may be looked upon as a commentary on and a summary of the climatic ones.

Density of Population.

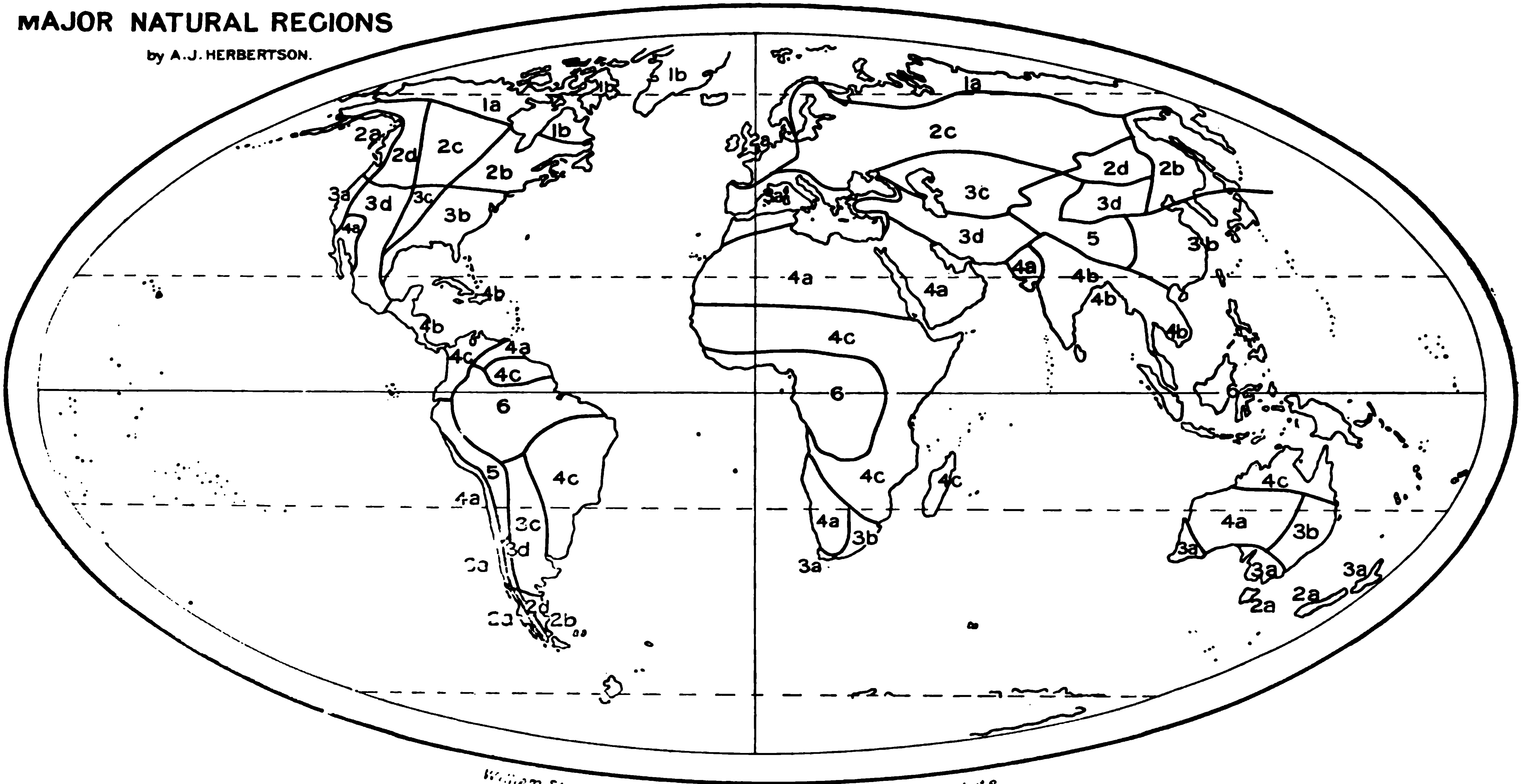
The mapping of human conditions has less significance in indicating the natural geographical regions, for the factor of human development has to be taken into account as well as the possibilities of the natural environment. The density of population map is the most direct expression of the actual economic utilization of the natural region. One has only to cite the central plains of North America before and after the introduction of railroads and the exploitation of minerals, to measure the importance of the human factor in determining this density. Each geographical region has its potentialities as well as its actualities, and a study of these is one of the most complex and fascinating the geographer can tackle. The necessary preliminary, however, is a just appreciation of the natural physical conditions of relief and climate.

Hitherto it has been customary to study the geography of the World according to political divisions. These, expressing the most complex and comparatively unstable of human conditions, must be eliminated from any consideration of natural regions.


SEASONAL RAINFALL
Based mainly on Supan's four Seasonal Maps
by A. J. HERBERTSON
Spring
Summer
Autumn
Winter
All Seasons
No " "
The various cross rulings indicate the Seasons which have more than 6 inches of Rainfall
William Stanford & Company Ltd., The Oxford Geog! Institute.

MAJOR NATURAL REGIONS

by A. J. HERBERTSON.



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Natural Geographical Regions.

In the determination of natural regions, climate and configuration must both be considered. Climate, because it not merely affects the physical features, but also because it best summarizes the various influences acting on the surface. Climate even more than configuration, for the great barriers of the lands are climatic—wastes of arid desert or ice mountains—for it is the climate more than the configuration which renders lofty mountains effective barriers. Only when minor forms are taken into consideration does configuration become the all-important factor. On the accompanying map I have ventured to outline the regions which the consideration of all factors seems to me to determine.

A natural region should have a certain unity of configuration, climate, and vegetation. The ideal boundaries are the dissociating ocean, the severing mass of mountains, or the inhospitable deserts. As a rule, save in the case of the shore, the boundary is not at all well marked, but the characteristics of one region melt gradually into those of another. Premising that the lines on the map are taken as the approximate central lines of the transition areas, we may divide the world up into the following types of natural regions:—

1. Polar. (*a*) Lowlands (Tundra type); (*b*) Highlands (Ice-cap type).
2. The cool temperate regions. (*a*) Western margin (West European type); (*b*) Eastern margin (Quebec type); (*c*) Interior lowlands (Siberian type); (*d*) Interior mountain area (Altai type).
3. The warm temperate regions. (*a*) Western margin with winter rains (Mediterranean type); (*b*) The eastern margin with summer rains (China type); (*c*) The interior lowlands (Turan type); (*d*) and the plateau (Iran type).
4. (*a*) The west tropical deserts (Sahara type); (*b*) East tropical lands (Monsoon type); (*c*) Inter-tropical tablelands (Sudan type).
5. Lofty tropical or sub-tropical mountains (Tibetan type).
6. Equatorial lowlands (Amazon type).

The importance of regarding the Earth in this way can hardly be overestimated. Take, for instance, the application to education. Knowing each of the chief types, it is a simple matter to learn the peculiarities of each variety, and a great saving of time is effected, while the intellectual discipline of distinguishing the species and comparing the varieties is great. The application to economic and political affairs is even more obvious. Speaking generally, the permanent elements of each region are similar, and the history of the exploitation of the variety of any type of region where human development is most advanced should be of great profit to those interested in the exploitation or administration of the relatively undeveloped varieties of the same type. The recognition of natural regions gives the historian a geographical foundation for his investigations into the development of human society, such as he has not hitherto consciously possessed. By comparing the histories of the same race in two different regions, or of a succession of races in the same region, it should be possible to arrive at some knowledge of the invariable effect of a type of environment on its inhabitants, and permit some estimation of the non-environmental factors in human development. It would be difficult to exaggerate the importance of this investigation, which seems to me a fundamental one for all who have to deal with the study of man, or with his economic exploitation or his proper government.

No one is better aware than I of the incompleteness of the present communication, but I venture to make it in the hope that it may start criticism, and ultimately lead to a better understanding of one part of geography, and of its practical as well as its theoretical importance.

In future papers I propose to deal in some detail with each type of natural region and its varieties.

After the reading of the paper, the following discussion took place:—

Dr. MILL: I am much interested in this attempt of Mr. Herbertson's to introduce something more systematic into the classification of natural regions, but I have hardly given the subject sufficient attention to justify me in opening the discussion upon it. My own views on systematic geography I have already elaborated and set forth to the best of my ability in my address to the British Association in 1901. I should like to ask Mr. Herbertson for what purposes he proposes to use those natural regions? Are they to take the place of the old division of the world into continents, or are they to be used for such discussions as are concerned with the distribution of climatic and botanical phenomena?

Dr. HERBERTSON: The continents would be as at present. This is a cross-division trying to consider all the factors, classifying the natural regions of each continent, by means of which we can connect one continent with another, such as Europe and Asia, or Africa and South America.

Dr. MILL: Understanding that, I am confronted with this very serious difficulty. Whatever one of the many distributions we consider, we shall find that if there is a classification possible with regard to it, it will in some respects run counter to the classification required for the consideration of other phenomena, and it is quite impossible, as I know from an attempt that was made, to get a classification of the world in natural regions that would satisfy the workers in several branches of science. The only classification equally suited for all purposes is that of coast-lines and degree-net. And my feeling is, the more general we can make the physical classification the better. I do not think we require to go beyond the purely orographical. It seems to me that the science of geography has to do essentially with the action and reaction of the configuration of the Earth upon the many mobile distributions, and that one classification or another classification may be appropriately adopted when we consider one or another of these conditions. But my feeling is that for the general purpose we should stick to the degree-net, the coast-line, and the contour-lines, which are necessary and sufficient. That appears to my mind to meet the contention that such a larger subdivision is necessary, and I fear that as our knowledge of climate advances, the lines dividing areas will be continually modified. I remember once trying to draw a map of Africa treating of the relative climates, taking into account all the conditions, altitude, latitude, prevailing winds, etc., and it was most difficult and very unsatisfactory. We must have more knowledge than we now possess before such a map could be drawn; ultimately it might be possible. But it is desirable that an attempt should be made to extend our knowledge and widen our grasp of the inter-relation of phenomena, and in that direction I think this paper of Mr. Herbertson's is extremely suggestive and most valuable, and I am quite sure that if it is further considered and published with the maps which have been exhibited, it will exercise a very considerable influence in promoting interest in geographical science.

Mr. DOUGLAS FRESHFIELD: Dr. Mill has already said all, or almost all, that I should care to say very much better than I could have said it. It seems to me that this attempt to create what I think Mr. Herbertson called in his paper genera in regions is a very difficult one. You will only get your genera by disregarding certain points in which regions differ. It may be an instructive inquiry, but I am rather doubtful as to its usefulness in teaching. I am afraid that as we grow more and more scientific we are liable to mix up geography with every

other science on the face of the Earth. And if we wish to promote geographical education we ought not to make it more complicated than we can help, though I fully recognize it must be complicated. Still, I hope we shall try and keep geography as far as possible to a definite field, and not intrude on geology or other sciences.

Mr. YULE OLDHAM drew attention to the difficulty of representing climatic regions cartographically, owing to the great difference between the horizontal and vertical temperature gradients, an elevation of 300 feet producing as great a change as is obtained by moving through a degree of latitude.

Mr. RAVENSTEIN: I have but little to add to what Dr. Mill has said. I think with him that the primary factor which determines geographical regions is elevation, and also the direction of the mountain ranges. There can be no question that the great plain of India, extending from the Ganges to the Indus, and bounded by the Himalayas and the Deccan, constitute one of these natural regions, and has its analogue in the great plain of Scotland. If you consider the effect which mountain ranges and plains have upon climate, the direction of the wind, the rainfall, and many other phenomena, you will find this is our only practical method. Comparisons such as have been made to-day by Mr. Herbertson are highly interesting and instructive, but I do think that for practical purposes they cannot act for us as guides, and they do not enable us to lay down geographical regions which would be universally accepted. I think, at the same time, that the term "region" ought in all cases to be applied in the way Mr. Herbertson does—that is, to portions of the Earth's surface which have something in common in their physical features and characteristics, and therefore "regional geography," I do think, is a very happy term to employ when we really mean chorography. Of course, chorography is not a word much used, whilst topography is; but I do think the department which invented that comprehensive word "catchment basin," might suggest a term equally acceptable for "Länderkunde," or chorography.

Dr. HERBERTSON: I do not think that the speakers have quite appreciated my difficulty. In trying to divide up the world into its major geographical units, relief is not a complete guide. For instance, in North America there are no very marked orographical features in the central plains, yet the difference between the parts round the Arctic ocean and the shores of the Gulf of Mexico is almost as great as that between the pole and the equator. Again, let us take the case of South Africa. The south-west corner, from the point of view of orography, and to a certain extent of structure, is practically the same as the south-eastern corner, but otherwise they are as far apart as Spain and China; for in the south-west, rains occurring in winter instead of in summer produce quite a different type of vegetation from that of the south-east with summer rains. You cannot read those differences from the orographical features. If this fundamental difference had been recognized in the war, it would have saved much. For teaching purposes it is desirable that we should find out what regions can be grouped together, so that by studying, say, fifteen or twenty types, the main features of the greater part of the world are learned, and merely the details of the varieties of each type have to be mastered later on. In practice this results in a saving of much time, and adds greatly to the value of geography as an intellectual exercise. Another reason why my classification takes more than orography into account, is the necessity for this in economic and political applications of geography. The historian has done comparatively little to elucidate the influence of geographical conditions on history, because the geographer has not yet put his material into a form which the historian can use. It has hitherto hardly been possible to eliminate the human factor by either comparing the sequence of historical events in a region of a particular character, or by

comparing the human history in different types of the same great species of region, and it seems to me from this point of view alone it is worth while trying to divide the world into natural regions.

Mr. MACKINDER: While I agree with Mr. Herbertson in most of his ideas, I hope that the expression "systematic geography" will not take root. This is an important point, and not one merely of words. Mr. Herbertson's real aim, as it appears to me, is to obtain a method for "Regional Geography," an expression which has, I think, taken root. I think that "systematic geography" is based on a wrong analogy. In "systematic botany" there are indefinite myriads of individuals in each species, but in the case of geography that would not be so; there are quite a limited number of natural regions, and therefore not more than a very few specimens in a species. The chief aim of Mr. Herbertson's paper is a valuable one, but it is not what his title suggests. He seeks, as I believe, the best compromise of criteria for determining the natural regions of the world—in other words, the "method" appropriate to regional geography. Systematic geography is not a self-evident expression, whereas regional geography is. Moreover, it is a rough equivalent for the German expression "Länderkunde."

Mr. RAVENSTEIN: No. Länderkunde is chorography.

Mr. MACKINDER: Chorography is not English; it is a heavy word that will never take root, and the nearest approach to it is regional geography. It appears to me a pity to confuse the public with a new term such as "systematic geography" when you mean no more than can be conveyed by the term which some of us have been labouring to establish in current use. We must take the balance of matters into account. One other point. I know that Mr. Herbertson will agree with me that for the purpose in view we must avoid the use of isotherms reduced to sea-level. They are absolutely useless for all purposes of this kind. What we require are isotherms as they actually determine the growth of vegetation on surfaces of varying elevation, and if you have such isotherms you will see they will sympathize with the contour-lines, and so give you clearer indications of the natural regions.

The CHAIRMAN: As the matter is one of purely technical education I fear I can offer no criticisms of any value whatever. I think Dr. Mill has expressed the general feeling of the meeting on the paper. For my own part, I thoroughly agree that the foundation of geographical education should be orographical, and that other subsequent considerations should be based upon that. To judge from my own experience, I should say that the varieties of nature are so infinite that I hardly conceive it possible to co-ordinate different parts of the world and to bring them under one head as a type of regional geography. Anyhow, Mr. Herbertson has introduced a subject of very great practical importance in geographical education, and I am sure I shall carry the meeting with me in thanking him very much for the address he has been good enough to give us.

REVIEWS.

EUROPE.

SWEDEN.

'Sweden. Its People and its Industry.' Published by order of the Swedish Government, and edited by Gustav Sundbärg. Stockholm: 1904. Pp. xi., 1142. *With Maps.*

THIS comprehensive work on the country and people of Sweden, forming a volume similar to that on Norway published by the Norwegian Government with

a similar purpose in 1900, appeared in that year in French, and was issued at the Paris Exhibition. The editor in his preface admits to unforeseen delay in the production of the present English edition, but has added an appendix giving certain supplementary facts to date, besides amending the text in certain places when necessary. The book is an admirable work of reference on every phase of Swedish life. The subjects of physical geography, with climate, flora, and fauna; history, demography, constitution, government, education, and social movements, and every branch of industry and commerce are dealt with by experts. Parts of the text lack the revision of an English hand (though its intelligibility at least has not been noticed to suffer), and a bibliography, even though mainly Swedish, might have been acceptable to some English readers; but apart from this the volume is beyond criticism. The configuration of the land is admirably presented by Dr. Gunnar Andersson. He divides his country into four physical regions. Upper Sweden includes all the main mountain chain of "the Keel" which falls within the kingdom, but extends thence to the Bothnian coast, and perhaps, therefore, might be more fitly termed the Norrland region, after the old territorial division with which it nearly coincides. The central lowlands continue southward to include the great lakes, Vener and Vetter; the Småland highlands lie south of these, and the fertile plains of Skåne (Scania), the richest agricultural district of Sweden, southernmost of all. The last is almost a land apart, but interesting parallels occur between the other divisions. Thus the Norrland region falls into three well-marked belts—the Alpine region of the high mountains; the middle belt of low hills and marshes, which, with its forest covering, has a very near counterpart in the so-called Småland highlands; and the coastal belt of recent marine deposits, which is actually a continuation of the central lowlands, as these deposits remain from the much-extended Baltic sea, which covered most of Finland and connected with the White sea. It may be noted that the extent of this sea, which has also left a debased marine fauna in the great central lakes, is excellently shown on a map.

Turning to the Alpine region, it would probably surprise few to learn that the extreme heights are as yet by no means fully explored from the scientific standpoint. The special locality, however, which Dr. Andersson indicates as little known is not, as might be expected, the line of heights from Kebnekaise, near Lake Torne, southward to Sulitelma, but those south of the headwaters of the Ume, in the vicinity of Rösvand, at the head of the Vojme and the Ångerman rivers, and southward towards the Jemtland highlands, where the Stockholm-Trondhjem railway crosses the pass of Storlien. Much interest attaches to the great lakes which lie on the eastern flank of the Keel in Norrland. Dr. Andersson points out that all occur between heights of 1000 and 1400 feet (roughly), and have many other features in common. He instances that their greatest depth is generally towards the western end (which, to judge from appearance, is the case), but corroborative details are not given. The work of glaciers upon the pre-glacial river-beds is generally assigned as the origin of these lakes, but "it is possible that an uneven upheaval of the land may have brought about changes in the watercourses." The remaining physiography of Sweden is too well known to need comment here, but each region is treated with clearness and precision.

The consideration of the industrial development and progress of the country occupies over one-half the volume. In this connection the main point of geographical interest lies in the iron-mines, which, along with her forests, are Sweden's richest economic possession. They fall into two groups—those in the region of the central lowlands, and the Arctic mines. Of the second the Iron mountain (Malmberget) near Gellivara has long been worked, but of far greater extent

are the deposits at Kirunavara and Luossavara, which the new northern railway, crossing the frontier by way of Lake Torne to Narvik, in Norway, has recently opened up. The foundation of smelting works near the Bothnian port of Luleå opens a new industrial field here (for hitherto the ore has been exported in a crude condition); and, considered in connection with the physical and climatic obstacles to be overcome, this seems likely to become one of the most remarkable industrial regions in the world.

Every possible subject, physical, ethnographical, and economical, is clearly illustrated on maps in this volume, and numerous photographs are reproduced.

O. J. R. H.

European Cartography.

'Skizze der Entwickelung und des Standes des Kartenwesens des ausserdeutschen Europa.' Von W. Stavenhagen. *Petermanns Mitteilungen*, Ergänzungsheft No. 148. *Price* 16*m*.

In this latest addition to Petermann's notable series of Ergänzungshefte, the author, Captain W. Stavenhagen, has rendered an immense service to all students and teachers of geography. One of the chief obstacles in the way of original geographical work has hitherto been the difficulty of ascertaining the scale, mode of production, and reliability of standard maps of different countries. This difficulty does not exist for the cartographical specialist, and it is perhaps not a serious one for the trained geographer; but, to take this country alone as an example, how many engineers know the different editions of the 1-inch Ordnance map and their merits, and how many school teachers, willing and able to use maps of different countries, can easily find any information beyond what is contained in a few short articles on "specimen sheets" in educational magazines? Captain Stavenhagen has produced a work of reference which removes the difficulty so far as the countries of Europe are concerned. Germany is not included in this volume, but is to have special treatment.

But besides a critical "bibliography of maps," Captain Stavenhagen gives a series of short but very adequate summaries of the history of map-making in each country, which places his book in a high position as a work of critical research, and give it a great value to the cartographers of all nations. The comparative study of different stages of map-development cannot fail to be of service to the authorities of all countries really awake to the paramount necessity of good maps for purposes both of peace and war, and it may, as Captain Stavenhagen hopes, pave the way for a system of international co-operation similar to the international Geodetic Commissions, which will include not merely the production of a map of the world on a scale of 1 : 1,000,000, but the adoption of uniform standard methods in the larger-scale maps.

An introductory chapter is followed by a historical review of the cartography of Europe as a whole. Ancient maps and maps of the middle ages are dismissed in two pages, and the modern period is divided in five sections—the Renaissance to the reform of cartography, the Reformation (Mercator, Ortelius, etc.), in the transition period (Blaeu, Moll), the period of triangulation and geodetic surveys, and modern cartography. Next follow the regions of Europe in detail: Central Europe includes Austria-Hungary and Switzerland; Western Europe, Great Britain and Ireland, the Netherlands, Belgium, Luxemburg, and France; Eastern Europe means Russia; in Northern Europe are Norway, Sweden, and Denmark; Southern Europe is subdivided into three, the Iberian, Apennine, and Balkan peninsulas.

It is, of course, impossible even to describe the contents of the different chapters. By way of an example, we may, perhaps, refer to the chapter on Great Britain and Ireland. The growth of British cartography up to the middle of the eighteenth

century is given in outline; then follows a short account of the beginnings of the Ordnance Survey. The progress of its work and establishment up to the present time are given in considerable detail, and a critical description of the maps as now published. The last section deals with maps issued by other authorities and by private firms. These include the Hydrographic Department of the Admiralty, the Geological Survey, the Post Office, and the Railway Clearing House, and such firms as Messrs. Bartholomew, W. & A. K. Johnston, Stanford, and others. The chief maps of the British Isles published abroad are also described. In the whole work we find abundant information, and, except for some misprints, such as the name of the first hydrographer on p. 95, substantial accuracy, while criticisms are fair and just, even generous.

ASIA.

The Trans-Siberian Railway.

'Le Trans-Sibérien.' Par A. N. de Koulomzine, Chargé d'Affaires du Comité du Trans-Sibérien, traduit du Russe par Jules Legras.' Paris: Hachette. 1904. Pp. viii., 326. *Price* 5*s*. 8*d*.

This work forms a companion volume to the 'Official Guide to the Great Siberian Railway' (1900), but it brings down the history of the great Asiatic trunk-line to the latest time, and includes a detailed account of the Manchurian—the so-called "East Chinese"—extensions. Among the excellent photographic illustrations of railway detail are views of the building of the cantilever bridge over the Ob (p. 84), of the rock-cutting in the construction of the Circum-Baikal section (p. 120), of the solitary tunnel on the line, that on the summit of the Yablonovoi hills with its inscriptions, *K' Velikomu Okeanu*, 'to the Pacific' (p. 132), and of the 5-furlong iron bridges over the Yenisei and the Sungari (pp. 142, 152). The subject-matter is divided under four heads, (1) "Histoire administrative," (2) "Construction," (3) "Colonisation," (4) "Résultats du Trans-Sibérien;" and a series of diagrams are appended, illustrating the movement of traffic (both passenger and goods) upon the Siberian system from 1897 to 1902, as well as the progress of emigration from 1882 to 1902. Finally, two maps of Siberia are appended, showing not only the railway and all its subsidiary schemes (the Pem-Kotlas, Samara-Orenburg, and other lines), but also the chief emigrant districts, the position of the principal known deposits of gold, silver, iron, coal, and copper, the lighthouses on the Baikal, and the meteorological stations along the whole of the trunk system. How far the railway was beginning to fulfil its commercial and civilizing functions up to the outbreak of the present war may be partly gathered from such facts as these. In 1898–9 less than 150,000 puds of grain were carried; in 1901 nearly 13,000,000 (though the *export* of cereals by the railway has diminished since 1898). Again, in 1890, the last year before the commencement of the "Trans-Siberian," 47,378 immigrants entered Siberia; in the next year (1891) the figure rose to 82,000, and has only once since fallen below that annual level (in 1893, when it was 61,000); while since 1895 it has regularly exceeded 100,000 (save in 1897, 86,000), rising in 1896, and 1898–1900, to 202,000, 206,000, 223,000, and 219,000 respectively.

C. R. B.

The Dutch in Java.

'The Policy and Administration of the Dutch in Java.' By Clive Day, PH.D. Macmillan Company. 1904. Pp. xxi., 432. 8*s*. 6*d*. *net*.

This is a useful contribution to the literature of colonial administration. It is based very largely on Dutch sources, little known and inaccessible to the general reader, and in his preface Prof. Day points out that between the descriptions of

Dutch policy current in English, and the facts as they appear in the writings of Dutch historians, there is a wide divergence. The Dutch, in fact, have been severe critics of their own failures in attempting to administer Java. Holland was among the first of European nations to attempt the exploitation of a tropical land, and every step was necessarily experimental. The *régime* of the Dutch East India Company, which later added political power to its possession of a commercial monopoly, failed to gratify itself either morally or financially, and at the time of its dissolution in 1798, the debts of the company amounted to more than 134,000,000 gulden. After a few years of tentative and not very successful administration by the state, Java passed temporarily into the hands of Britain, and the well-known work of Raffles is associated with this brief period of British rule. The island was restored to the Dutch in 1816, who retained the land-taxes introduced by Raffles, though it was found almost impossible to put it on any fair workable basis. The system of forced cultures, an inheritance from the company days, which Raffles had found it inadvisable to abolish, though he disapproved of it in principle and discouraged it in practice, became a marked feature in the middle years of the nineteenth century. This part of the Dutch East Indian policy in Java is the one best known in this country, and it has been extravagantly praised by Money and others. Prof. Day criticizes Money as an ill-informed, inaccurate, and untrustworthy writer, but his influence in forming opinion in this country has been great. Prof. Day, writing as an economist, points out that the crux of the problem of tropical administration is the failure of the native as a consumer, and that till his basis of consumption is widened he will do as little productive labour as possible. The system of forced culture educated him in production, but did nothing for his education in consumption, while it intensified the original reluctance to labour, and tended in its working to be harsh, unfair, and oppressive. A Colonial Reform party strongly opposed its continuance, and a gradual transition to wage labour took place between 1870 and 1898, in which year the Government coffee culture, the last of the forced cultures, was abolished. The chapter on recent economic policy is a thoughtful analysis of the causes which make up the tropical labour problem, and in it the writer insists emphatically on the *rôle* of the Chinaman in Java "as the missionary of the modern economic organization." Prof. Day gives his authority for every statement of importance, a practice which cannot be sufficiently commended.

PALESTINE.

'Die Verkehrswege und Ansiedlungen Galiläas.' By Dr. V. Schwöbel. Leipzig: 1904. Pp. 152. *With a Map and Diagrams.*

Dr. Schwöbel has subjected to a very close investigation the parts of Palestine between the Sea of Galilee (Bahr Tabarie) and the Waters of Merom (Bahrat el-Hule), Tyre, and Acre. His object is to trace the connection between the distribution of population in townships, and villages, and the communication lines, with the natural conditions of the district. The divide between the Mediterranean slope and the Jordan depression lies close along the valley of the Jordan itself, so that the tributary valleys to the Jordan are few and mainly insignificant, and the longer slope is that falling seaward. The southern boundary of the district under notice is the railway, which, from the coast at Haifa, follows the valley of "the brook Kishon," in a south-easterly direction, crosses the low divide into that of the Jalud, and then runs north up the Jordan depression to the foot of the Sea of Galilee. The northern boundary is the Nahr-el-Kasimie, where that stream turns west to the sea north of Tyre, having previously (as Nahr-el-Litani) followed a

south-westerly on the east side of Mount Lebanon. Of this district Dr. Schwöbel provides a map of remarkable detail, indicating by different signs the populations of settlements, from 10 to 10,000 and upwards. Springs are shown, perennial and intermittent streams are distinguished, and such features as marshes are clearly marked. Unfortunately, it has not been found possible to indicate elevations. Of the caravan routes, that which runs close along the coast is connected with that following the same direction inland along the Jordan (which turns off, north of Galilee, towards Damascus) by a series of cross-routes, the general direction of which accords roughly with the natural lines of communication from west-north-west to east-south-east. The map also shows local tracks. The relief of the country is separately displayed in a beautiful series of sections. A diagram shows the divisions of the country according to the density of population. In the text, Dr. Schwöbel appends to his instruction a synopsis of the authorities (English, French, and German) for the district. He then deals in successive chapters with the physical characteristics of the land and the economic conditions of the people, before turning to the special question of their lines of communication and their distribution. His transliteration of place-names, avoiding the use of capital initials, and replete with accents and signs, renders the topography difficult to follow for readers unacquainted with the original forms of names.

AMERICA.

The Andes.

'La Cordillera de los Andes entre las Latitudes 30° 40' i 35° S. Trabajos i Estudios de la segunda Sub-Comision Chilena de Limites con la Republica Arjentina.' Luis Patron S., Injeniero-jhefe. Santiago de Chile, 1903.

The Officina de Limites in Chile proposes to publish the most important data collected by the boundary commissions during the years 1894 to 1902; and this is the first volume issued. It contains the results of the work of the second sub-commission, which examined the country in the vicinity of the boundary from the Rio Mostazal southwards to the Rio Tinguiririca. Down to lat. 32° S. the Andes consist of three ridges frequently interrupted, of which the eastern is the highest. In the north, where it is called the cordillera de la Totora, it attains altitudes of over 16,400 feet. Between lat. 32° and 33° only the eastern chain exists, containing the heights of Mercedario (21,880 feet), and, in the south, the huge mass of Aconcagua. Four observations were made of the height of this summit, which Mr. FitzGerald gave as 23,080 feet, and the mean result was 22,830 feet. The interval from 33° to 33° 50' is occupied by the great massives of the Juncal, the Polleras and Tupungato, where the lowest gap is that of Tupungato, 15,594 feet. South of 33° 30' two cordilleras again appear, the western being here the more important and forming the continental watershed. From lat. 35° the watershed gradually becomes lower, its summits seldom reaching 13,000 feet, and the passes seldom exceeding 9800 feet. The rivers on the Chilian side are usually in the same line as those on the Argentine, and seem to be encroaching on the drainage basins of the latter. The commission extended a series of polygons along the boundary region, fixing many points astronomically and determining a number of heights. These geodetic results are recorded in the present publication, as well as observations of temperature and other meteorological phenomena, on glaciers, magnetic declination, which is marked by sudden variations, and other valuable information. The book is provided with maps, diagrams, and illustrations.

AUSTRALASIA AND PACIFIC ISLANDS.

Melanesia.

'Zwei Jahre unter den Kannibalen der Salomo-Inseln.' By Carl Ribbe. *Numerous Illustrations and three Maps.* Dresden: 1903. Pp. viii. + 352. *Price* 10*s*. 6*d*.

'Bilder aus der Südsee—Unter den Kannibalischen Stämmen des Bismarck-Archipels.' By Dr. Heinrich Schnee. 30 *Plates and Map.* Berlin: 1904. Pp. xiii. + 394. *Price* 14*s*.

Most naturalists are familiar with the name of Herr Ribbe, whose entomological, botanical, and ethnographic researches in Andalusia and Malaysia form the subject of numerous contributions to the transactions of the German Entomological Society, Dresden, and several other scientific periodicals. From Malaysia he extended the sphere of his investigations to New Guinea and Melanesia, where he spent altogether four years (1893–1896), devoting his attention more particularly to the northern section of the Solomon archipelago between about 6° and 9° S. lat. From his headquarters at the islet of Faisi, off the south coast of Alu (Shortland), several excursions were made to all the surrounding groups, which were carefully, one might almost say microscopically, studied in their manifold physiographical and biological aspects. Scarcely anything within the prescribed limits appears to have escaped the keen eye of this indefatigable observer, who here presents the grateful student with an all but complete picture of the fauna, flora, and ethnical relations in Rubiana (New Georgia), Ysabel, Choiseul, parts of Bougainville, and the "Shortlands archipelago." This expression, new to geography, the author proposes as a convenient comprehensive name for all the islets strewn over Bougainville strait, of which Shortland is the chief member, and which also comprised the important island of Fauro, known to us from Mr. Woodford's survey. This pioneer is briefly referred to now and then, but only one casual reference is made to Mr. Guppy, whose classical work on 'The Solomon Islands and their Natives' seems to be unknown to Herr Ribbe. He might else have dispensed with many details in his exhaustive account of these savages, whose daily life, weapons, domestic utensils, ornaments, tabu and totem systems, social and religious practices, scare-crows for driving away the circumambient demons, freemasonry, ailments, healing and cooking arts, industrial processes and languages, are all described with almost wearisome iteration. These treacherous and sanguinary head-hunting cannibals appear to have deteriorated rather than improved since their contact with the whites, and despite their artistic skill in woodcarving and one or two other commendable qualities, the author finds no epithets too strong for these "von Natur lügnerisch, verräterisch, räuberish, hinterlistig, diebish, und grausam angelegten Kannibalen," both in the German and English sections of the archipelago.

Herr Ribbe finds all existing maps, even those of Gotha and the British Admiralty, often most misguiding, as in the Manning strait, where "had we trusted to these maps we should have found ourselves in the middle of the island of Ysabel!" It should, however, be stated that at this point the map of the Solomons in Dr. Guillemard's *Australasia* (Stanford Series) corresponds exactly with that specially prepared for Herr Ribbe's work, except that the Cape Comfort headland appears as a peninsula in the former, and in the latter as an island barely separated by an extremely narrow channel from the mainland. Besides this there are two other maps on a larger scale, a pretty full index, a profusion of excellent illustrations, botanical lists, comparative anthropometric tables, and a good deal of linguistic matter, including vocabularies of six local dialects and sixty-eight words in thirty-four Melanesian, New Guinea, and Malaysian languages. Many of these

are found neither in Wallace nor in Codrington, and they thus supply fresh material for the study of the Oceanic tongues.

In his compact, well-printed, finely illustrated, and clearly written volume, Dr. Schnee gives us the results of his experiences during an official residence of over two years (1898–1900) in the Bismarck archipelago (New Britain, New Ireland, Duke of York), and some of the neighbouring groups. Coming from a careful and unbiassed observer, the book is all the more welcome since hitherto very little accurate information was available on the geographical and ethnical relations of this northern section of the Melanesian world. Even after the German occupation of over twenty years, Dr. Schnee is obliged to admit that these insular groups are still amongst the least-known lands in the world, and although he himself crossed New Ireland from west to east, most of the interior of the large islands remains a *terra incognita*. His own investigations were made chiefly in connection with various punitive expeditions to nearly all the groups between the Admiralty (now called Manus) and the Solomon archipelago. Hence he has little to say about the inland tracts and the bushmen, who are the true aborigines, and often differ markedly from the "Kanakas," as the better-known coast tribes are now generally called.

The plan of the book is excellent. Instead of slavishly following a chronological order, which has but a passing interest, the author devotes a number of chapters to those subjects of permanent importance which are more or less common to all the groups and their inhabitants, and then fills in the details of those vivid "pictures from the South Sea" according as the opportunities present themselves during the numerous expeditions in which he took part. Thus, to give one instance, Mussau (St. Matthias), scarcely mentioned in the general chapters, is dealt with very fully in connection with the punitive expedition of 1899 to that group. It was found to consist, not of one island, as still figured on nearly all maps, but of quite a little cluster of islets and reefs, with one conspicuous member, inhabited by full-blood Papuan savages, speaking apparently a stock language, with a decided taste for weaving, but also for human flesh. Indeed, cannibalism, with all its associated horrors, such as the lingering death of the victims and the bartering of dead bodies with neighbouring "markets," is everywhere present to a far greater extent than had hitherto been suspected, a fact fully confirmed by official returns.

In the chapter dealing with the native languages, a most interesting account is given of the "pidgeon English," which has become the chief medium of intercourse in all the groups, not only between the whites and the aborigines, but often, as in China, between the natives themselves. Almost all the words are English, although sometimes corrupted beyond all recognition, and there is no grammatical structure to speak of. But Dr. Schnee is wrong in stating that the only pronouns are *me* and *you*, which with *all* are made to serve every purpose, even a dual, "a trial," and plural, both inclusive and exclusive in conformity with this striking feature of the Melanesian tongues. *He* and *him* are certainly also current, as in *master head belong him he big fellow too much* = "the master has a very large head." This specimen will serve to show that this strange Oceanic *lingua franca* has been developed on much the same lines as that of the Chinese seaboard.

At present the seat of the German administration, and the chief centre of trade, industry, plantation enterprise, and missionary zeal, is the fertile and relatively healthy Gazelle peninsula, which forms the northern extremity of Neu Pommern (New Britain). Here the soil and climate are distinctly favourable, and the prospects of plantation culture excellent, if the difficult labour question can once for all be satisfactorily settled.

The author's brother, Dr. Paul Schnee, contributes a valuable chapter on the indigenous flora and fauna, and this *vade mecum* of German Melanesia is provided with a copious index and a large-scale pocket map.

A. H. K.

PHYSICAL GEOGRAPHY.

The New Seismology: Two New Text-books.

'Handbuch der Erdbebenkunde.' Von August Sieberg. Pp. 362. Braunschweig: Friedrich Vieweg und Sohn. 1904. Price 7.50*m*.

'Earthquakes in the Light of the New Seismology.' By Clarence Edward Dutton, Major U.S.A. Pp. 314. London: John Murray. 1904. Price 6*s*. *net*.

These two works, differing as they do in character, are alike in proving the ascendency of the new seismology and the direction in which the science is trending. Time was when earthquakes were regarded as belonging solely to the geologist; they were considered as the cause of the upheaval of mountains and the contortion of strata, but it became gradually recognized that the earthquake is an effect, not a cause; the discovery that the cryptoseismic disturbance, set up by a great earthquake, could be recognized all over the world, ushered in the new seismology and a new series of problems. Seismology has become more and more a science of wave-motion, and the study of the effects of earthquakes, which belongs rather to geography and engineering than to geology, is in danger of being neglected.

The first of the two works heading this notice is a compilation pure and simple, from sources so limited that the list of principal authorities consulted does not mention the name of Mallet nor the transactions of the Seismological Society of Japan. The sections devoted to the old seismology are scanty, and follow strictly on the lines of previous text-books; the sections devoted to the modern development of long-distance observations are more complete, but the limitation of the sources of information consulted by the author has in more than one case led to his ascribing priority to the wrong person. The most remarkable instance of this is where he attributes the initiation of earthquake investigation in Japan to Knipping and Naumann—an injustice to his own countryman Wagner, who introduced the use of the multiplying index in seismographs and constructed the instrument with which Knipping worked. It must, however, be allowed that the compilation, so far as it goes, is well done, and the book is in a manner up to date, for the paper by Prof. Milne in this *Journal* of January, 1904, is fully noticed.

Of a very different character is the second book. Himself a master of the old seismology, Major Dutton has a thorough knowledge of, and sympathy with, the new; practised both as an observer and a writer, he has produced what is indubitably the best handbook of seismology now available, and the only fault to be found is that the space required for its recent developments has crowded out what is the most practically important branch of the science—that is to say, the effects of earthquakes on human constructions, and the means of minimizing, if not preventing, the havoc wrought by them.

Too much importance is, perhaps, given to the supposed distinction between quakes of volcanic origin and dislocation or tectonic earthquakes, and in devoting an entire chapter to each of these classes Major Dutton seems to have followed his Teutonic predecessors in attributing importance to a distinction of doubtful validity. With few, if any, exceptions, all earthquakes—not counting as such the tremors which originate naturally or artificially at the surface of the ground—arise from a sudden relief of strain: the rocks composing the crust of the Earth are thrown into a state of strain, which gradually increases in amount till it becomes too great to

be resisted any longer, fracture follows, and the disturbance set up, propagated as wave-motion, constitutes what is known as an earthquake. To this cause must be attributed not only all tectonic earthquakes, but also the greater part of those classed as volcanic, and the difference in general character between the two may be attributed to the fact that in volcanic regions strain and fracture seem to take place at a lesser depth from the surface.

There is, however, another conceivable cause of earthquakes, in the sudden development of strain, whether by increase or decrease of pressure, as might be produced by the admission of high-pressure steam to a pre-existing fissure, or by its sudden condensation in a subterranean cavity. Neither of these modes of origin has been established in any single instance, though they seem probable in some, but the distinction between earthquakes which are due to a sudden relief of pre-existing strain and those due to a sudden production of strain seems more logical than the usual one between volcanic and tectonic earthquakes. In any case, the determination of the ultimate cause, though doubtless of interest from a geological point of view, is far from having the seismological importance as regards the resulting earthquake, which might be supposed from the space devoted to it in text-books.

One of the most important problems of seismology is the determination of the depth at which earthquakes originate. One method after another has been proposed, only to be abandoned as its failure to give a true answer became apparent, and Major Dutton has himself invented a method which he believes to be sound, and which would be sound if its application were not vitiated by a logical fallacy. In the formula he uses the term "intensity" in the sense of energy per unit of wave-front, but in the application in the sense of a degree of the Rossi-Forel scale, which, like every other scale proposed in place of it, is miscalled a scale of intensity, being in fact a scale of acceleration, or, more simply, violence of shock. The two are very different, and differ in their rate of variation with distance from the origin, so that we are still left with no certain and trustworthy method of determining the depth at which earthquakes originate, but have, on the other hand, a lesson in the danger of misusing words.

In that part of the book which has been dealt with it is no better, unless in style, than others already in existence, but where it comes to deal with the new seismology it stands alone, for there is no other simply worded and brief account of this branch of the science, which has grown so rapidly during the last decade. There is a good and sufficiently complete account of the instruments which have recorded earthquakes at over 10,000 miles from their origin, and an account of the results which have been obtained. At a distance of more than 20° or 30° from the origin the disturbance registered, by one of these instruments, comprises three distinct phases, often with the appearance of three distinct disturbances, between each of which the instrument comes to rest. The first two phases constitute what are known as the preliminary tremors, and the author adopts the view, which is still the more probable one, that they are mass waves propagated through the Earth, while the third phase is due to surface waves propagated along or near its surface. The first phase is pretty generally regarded as representing the condensational wave, the second is possibly the distortional wave, but the third is the great problem of modern seismology. Five years ago we knew a great deal about these third-phase waves; they resembled the radiating ripples on a pond, and we calculated their length and height, but now these ideas have been cast into the melting-pot, and the new ones have not yet been moulded.

It is unfortunate that the book was completed too soon to make use of Prof. Horace Lamb's important researches, which have done much to indicate the

nature of the wave-motion to be looked for, and regrettable that no use is made of the records of the very ingeniously devised Vincentini seismographs, probably from the imperfect publication of these records, which has led to the important indications they yield being almost entirely overlooked by seismologists. This is no place to enter on the discussion of a very controverted subject, but it is permissible to suggest that too little attention is generally paid to the fact that the disturbance recorded by a seismograph is but the superficial manifestation of the wave-motion, which has travelled through the rocks below the surface. The heterogeneous, weathered, and fissured rocks of the outermost layer are incapable of transmitting any pure form of wave-motion, or, indeed, any wave-motion at all for more than a short distance, and the movement which we are able to record must have travelled, whether along a more or less direct path through the Earth or round its surface, in the more compact and homogeneous rocks which underlie the outermost layers, then been transmitted to the surface, undergoing more or less modification on its way. It is, consequently, easy to attach too much importance to such matters as amplitude and period, for these vary with the instrument employed and the site on which it is set up. If the desire is to arrive at a knowledge of the character of the wave-motion, it is a mistake to depend too much on one type of instrument alone; if, on the other hand, the aim is to investigate the rate of transmission, and from this the path followed by the earthquake waves, it is important to have a widely scattered series of instruments of the same type and similar adjustment.

In this connection Major Dutton repeats a widely spread error, in giving State aid to the organization of earthquake recording-stations, which has arisen under the auspices of the British Association. Some of our colonies and possessions have assisted by setting up and maintaining instruments in their astronomical observatories, and the same has been done in England, but the assistance has been confined to this, and there has been no Government subsidy. The work has been helped on by many workers, the funds provided by private generosity and grants from the Royal Society and the British Association, but the initiative and organization have been entirely the work of Prof. Milne, and, comparing what has been done in these circumstances with the results of State-endowed services in other countries, one is reminded of the historic conversation between Dr. Adams and Dr. Johnson, who considered that a task which had taken the French Academy forty years was not beyond the power of an Englishman to accomplish in three. So far, indeed, is our Government from assisting the work, that it is understood to be not unwilling to grant assistance, refused in its own country, to a rival organization, nominally international, but established in a province and a city which renders impossible the co-operation of the most intellectual nation in Europe.

R. D. O.

COMMERCIAL GEOGRAPHY.

HERBERTSON'S COMMERCIAL GEOGRAPHY.

'Chambers's Commercial Geography of the World.' By A. J. Herbertson. London: W. & R. Chambers. 1905. *Price* 3*s*. 6*d*.

The first part of this volume is another edition of the author's 'Geography of the British Isles,' published five years ago; the second part covers the rest of the world, and the two are linked together by some chapters on general economic geography. The interest of the second part lies mainly in the plan. It is a protest against the method of the ordinary text-books, which take as a basis political areas and provide lists of unconnected facts to tax the memory of the reader. Here he finds himself carried rapidly from South Africa to South America, from Siam to Mexico, in an unconventional survey of regions. In the main, the

British Empire can be studied as a separate unit, but it is better to treat it comparatively, by keeping closely to the order of the text, which is based on similarity of physical conditions. In dealing with the great areas of the northern hemisphere, the author founds his classification rather on the various stages of economic advancement, and works from the lower to the higher—from Eastern Asia, through Russia and Europe, to the United States. The contrast to the usual arrangement is striking, and to those accustomed to the conventional system may present some difficulty. Intelligence is required of them rather than memory—a result greatly to be desired. But the book is more likely to be useful to the young student who has the advantage of competent guidance than to the unaided reader. Various tables of statistics are included in the volume, though the author is careful to state that they are merely for illustration, and designed to induce the habit of dealing with such figures in the light of geographical principles. The right way of using these, and other detailed facts, is to explain and understand; the wrong way is to commit them to memory.

A. J. S.

GENERAL.

The British Empire.

'Colonies and Colonial Federations.' By E. J. Payne. London: Macmillan. 1904. *Price* 3s. 6d.

This little book is a valuable addition to the English Citizen Series and to the general literature dealing with the colonies. In spite of the limited space at his command, the author (whose sad death is to be deplored) has succeeded in giving a vivid and stimulating picture of the past history and present condition of the empire. By grouping the facts in four sections—geographical, historical, economic and political—he has avoided many of the difficulties involved in chronological narrative and the dulness inseparable from a mere summary of unconnected details. The aim of the whole book is to attain unity of view, a unity founded largely on geographical conceptions. We start with the British people, in contact with certain physical facts; we add, as the motive power of expansion, hostile pressure from without, and the result is the Empire in its present shape. Essentially, it is a chain of communications, with a definite relation to the great trade routes of the world, and to the commercial and strategic necessities of a maritime nation. In the light of this central idea, the forging of the different links in the chain is traced; the result appears as the inevitable consequence of the policy of many generations of workers, each occupied with the needs of the moment rather than with plans for a distant future. This conception may, at times, be unduly pressed, but the resulting picture has a force and unity which no mere narrative could give. The empire is more than a chain of commercial stations, important as these are; it includes areas of a marked continental character. Certain links in the chain have provided new points of departure for the extension of colonization and the growth of great communities with a history and development peculiar to themselves.

None the less, Canada, Australasia, and South Africa, equally with Gibraltar and Malta, have strategic and commercial aspects vital to the whole system. To refuse recognition to this fact is to deny the significance of four centuries of history, and to be blind to the present teachings of geography.

On the economic side, the diversity of the products and physical conditions of the Empire is a bar to clear description; but a not unsuccessful attempt is made to introduce a certain order and unity, by a classification of regions, based on the type of civilization of their inhabitants and the relation of their products to the future needs of the world. In the economic and historical sections alike, the idea

of geographical necessity dominates the methods and views of the author, and is in part responsible for some strongly expressed opinions as to past events and current problems. The controversial character of such opinions in no way detracts from their value, as calling attention to an aspect of the colonial problem which is often neglected in current discussions.

A. J. S.

THE MONTHLY RECORD.

EUROPE.

Bremen's Commercial Importance.—A lecture delivered by Dr. F. Tetens to the *Verein. für Staatswiss. Fortbildung*, on its visit to Bremen on November 21 last, and printed in the *Deutsche Geographische Blätter* (Bd. 27, Heft 3-4), takes stock of Bremen's commercial importance, and shows how dominant is the part played in its development by physical geography. The text is illustrated by graphic tables telling their tale at a glance. The smallest of the free states of Germany, Bremen is yet in population ahead of ten others. Again, although its port ranks second in the German Empire, it is yet at a long interval from Hamburg, which boasts of much more than three times the trade of Bremen. The difficulties with which the trade of Bremen has to contend include the following: (1) The immediate environment is poor, without large industries and cities. (2) It has at great outlay to maintain its sea communication up to the requirements of the increasing magnitude of ships. From 1888 to 1895 it had, among other expensive items, to deepen its waterway to the sea to the depth of 50 feet, while the State debt of 180,000,000*m.* is due mostly to harbour improvement works. (3) The sea trade of Bremen State is divided between Bremen and Bremerhaven, the larger half falling to the latter. (4) Whereas Hamburg has for centuries been the place of transhipment between the sea and the Elbe, and therefore, in one respect, Austria-Hungary's most important seaport, the region tributary to the Weser inland is now restricted on every hand: on the west by the Rhine and the Dortmund-Ems canal, which is about to be strengthened by improved connection with the Rhine; on the south by the Rhine region, especially by the basin of the Main. Then from Bremen to Münden, in Hanover, is but 228 miles, and navigable for only 350- (metric) ton ships. The Elbe, on the other hand, is navigable 602 miles. The Maas is another rival of the Weser. Bremen's main importance, therefore, is as a *sea* harbour. Of the total sea tonnage of Germany, Bremen owned, in 1889, 26·4 per cent.; in 1903, 28·3. The growth of its cotton import is remarkable. In 1889–90 it amounted to but 500,000 bales, against 2,800,000 imported by Liverpool; in 1902–3 it reached 1,650,000, against Liverpool's import of a little over 2,000,000 bales. The inland shipping trade of Bremen, on the other hand, is incomparably smaller than that of Hamburg, nor does it bear comparison with that of the Rhine ports, Duisburg, Ruhort, and Mannheim. Hamburg's export by river alone exceeds the total export of Bremen by sea, river, and land.

Régime of the Theiss.—The hydrographic division of the Hungarian Hydraulic Works Direction at Budapest has made a thorough investigation of the *régime* of the Theiss. From a summary of the results made by Edmund von Bogolánfy, we extract the following: From the inundations, for which, more than any other, this specifically Hungarian tributary of the Danube is noted, it might readily be inferred that its bed was shallow. In reality, however, its bed from source to mouth is cut deep into the surface of the land, and most of the year the river is confined strictly within its low narrow water-channel. By the

middle of October the water is at its lowest. The discharge then amounts in the upper course to 1400–2300 cubic feet per second; in the middle course (Tokay-Szolnok) to 3500–4100 cubic feet; and in the lower course (at Szegedin) to 7000 cubic feet. Of the last half-century, 1863 was in this quarter the driest year. Yet in recent times a lower minimum than was reached that year has been several times observed, whence it is to be concluded that the bed of the river has since been deepened. This deepening is due to the regulation works of the river; the shortening, by a third, of the natural course of the river by means of cuts; and the embankment of the area of inundation. If the bed throughout the entire length of the river is filled to the brim, then approximately half the maximum high-water supply is discharged, a circumstance which in its turn reacts on the deepening of the bed. Such maxima occur in spring (March and April), in summer (June), and in autumn (October and November). It is seldom that, as in 1876, all occur in one year. But equally seldom is it for a year to pass without high-water level being once attained. It is only on the upper course that all three make themselves felt; on the middle course only the first two; on the lower course only the spring maximum. During high water the river has a discharge of 81,000 cubic feet per second in its upper course; 150,000 cubic feet in its middle course; and 120,000 cubic feet in the lower course. It is in the middle course, therefore, *i.e.* near Tokay, that the high-water volume attains its maximum. The high-water marks are in places 3 feet 8 inches to 7 feet 3 inches higher than formerly, a fact to be accounted for by the effect of the embankment. At the same time, while the duration of the inundations has diminished, the velocity of discharge has increased. The fact that the ground is mostly impermeable, together with the steepness of the fall, is the primary cause of this velocity. In the upper course the fall amounts to 5170 feet in 164 miles, or 1 : 161; in the middle and lower courses, on the other hand, to only 108 feet in 431 miles, or 1 : 21,000. There are places where the fall sinks to as low as 1 : 100,000. It is, therefore, only in its upper course that at high water the Theiss has the character of a torrent. In its middle and lower courses it must be classed at all stages as a quietly flowing stream. The heavy boulders are accordingly dropped at the foot of the mountains. From the beginning the Theiss has transported fine sand and mud into the Hungarian plain, and so laid the foundation for the celebrated fertility of the latter.

Banks on the Coast of the North Sea.—A barrier of islets lies off the coast of the North sea from Blaavandshuk in Jutland to Texel in Holland, and among them lie a large number of banks which are exposed at ebb tide. Dr. Eug. Warming has devoted considerable attention to the fauna of these *vader*, as they are called. The outer zone of the sandy vade he names the Arenicola zone, after the worm *Arenicola marina*, which is extremely common. This organism never leaves its horseshoe-shaped dwelling, and probably does not assist in consolidating the mud. Its zone merges into one characterized by the presence of an amphipod (*Corophium grossipes*), which plasters the walls of its holes with its excrements. Algæ also assist in increasing the depth of the layer of mud and preparing it for a higher order of vegetation. On the clayey vader plants are the chief agents in transforming the ground into saline meadows. Of animal forms, gasteropods are the most important. Scratching the surface of sandy plains covered with water during storms, Dr. Warming found a network of Phycochromaceæ 3 to 5 mm. in thickness. Diatomaceæ were also represented by a large number of species. These and many other specimens of animal and vegetable life are fully described by Dr. Wesenberg-Lund and Herre strup.

Currents in the Kattegat.—In 'Om Yttström och Bottenström i Kattegatt

af A. W. Cronander,' a number of the *Proceedings* of the Swedish Academy of Science, Messrs. Pettersson and Arrhenius deal with the theory of Prof. Cronander, put forth in his 'On the Laws of Movement of Sea-currents and Rivers,' that the wind is one of the most important causes of currents. From long series of observations made at the Fladen lightship, the authors show that the maximum velocity is not always at the surface—the mean, indeed, for the stream entering the Kattegat is greatest for a depth of 5 metres—and the velocity does not decrease towards the bottom with anything like the rapidity demanded by the Zöppritz formula, even if the wind be supposed to blow in the same direction for thirty days. The observations bear a close resemblance in character to a series recorded for the Motala river near Norrköping, and the current in the Kattegat, which as a rule extends to the bottom of the channel, is probably due to the same cause, namely, difference of level, the water being higher in the North sea or Baltic according as the water flows inwards or outwards. Double currents—a surface current and a bottom current in the opposite direction—are less frequent in the Kattegat than in the Great Belt, and are very rare in the shallower parts of the Sound. Other series of observations are adduced to prove that the theory that the salt bottom layer in the Kattegat is an under counter-current produced by the outflowing surface current is incorrect, for the fresher and salter waters move in general in the same direction. The presence of a salter bottom layer in the depths of the Baltic may be explained by the greater velocity of the inflowing current, especially at depths of 10 and 15 metres. As regards the damming up of the water by the wind, Messrs. Pettersson and Arrhenius hold that the effect is confined to the surface water, and can make itself felt to any considerable depth only when the wind blows from the same quarter for an unusually long period. Atmospheric pressure, on the other hand, affects all the layers of water to the bottom.

Currents of the Straits of Messina.—Prof. G. Platania treats of the currents of these straits in connection with interruptions in telegraphic communication. (*Rivista Maritima*, August—September, 1904.) He holds that in many cases in which damage to cables has been attributed to earthquakes, the real cause has been friction produced by currents, and points out that an investigation of these injuries, their time of occurrence, etc., would yield valuable information regarding currents all over the world. In support of his conclusions, he shows that the broken cables generally show signs of friction, and that interruptions have been more frequent in the Straits of Messina at the lunar syzygies than in quadrature, and have been less frequent since the cables were moved to the north of the straits than when they were at the narrowest point. The submarine current runs in the same direction as the surface current, and with it changes its direction every six hours. The contours of the coast and the bed of the sea render the movements more complicated, producing lateral induction and vertical currents. Atmospheric pressure and winds may also exaggerate the difference of level and prolong the duration of the surface currents in one direction, giving rise to compensation currents. A systematic course of experiments on the currents of the strait, with records of temperature and salinity determinations would be of great scientific value.

Cartography of the Balkan Peninsula.—Dr. Dragutin Derok, of Belgrade, is about to compile a new general map, in twelve sheets, of Old Servia and Macedonia, making use, for the purpose, of all the topographic materials collected in the last decade, more particularly by Jovan Cvijić and his disciples, Janković and others. It is to be engraved, photographed, and printed in Berlin. The basis of the work will be the well-known general map of Middle Europe, on the scale of 1 : 200,000, compiled by the Military Geographical Institute in Vienna, only it will

be reduced to the scale of 1:250,000. Like this, the separate sheets will form trapeziums of a polyhedrical projection, but, on the other hand, will count their meridians from Greenwich. The southern sheets especially will present new material as regards configuration, *e.g.* of the Peristeri mountain, and in the neighbourhood of Saloniki. The vertical configuration of the land will be represented by contour-lines 100 metres apart, and rendered further apparent to the eye by the aid of light hachuring with oblique illumination. The map will show much that is new in respect of the distribution of settlements, and of nomenclature. The large places in a division as small as that of the circle will, for the first time, find cartographic recognition in the new map. The orthography of the names (which will be in cyrillic character) will throughout be determined by the pronunciation of the local Slavonic races. In the delimitation of the vilayets and sandjaks, the reconstruction effected in Turkey some two years ago will, for the first time, be here taken into account. All highways and roads (even down to footpaths), post-offices, and telegraph lines will find a place. Places, moreover, in which there are Servian schools will be noted as such. The work is, in fact, especially intended for the use of such schools, as a map of the mother country (Himatskarte), no less than as a military map. It will appear in the course of the present year, and will be published by a union of young Servian geographers.

ASIA.

Mr. Huntington's New Expedition.—Mr. Ellsworth Huntington has set out, accompanied by Mr. R. L. Barrett, on a new expedition into the heart of Asia for geographical research. The travellers, who made a short stay in England *en route* for the East, give the following sketch of their proposed plans. The expedition, which is under the auspices of the Association of American Geographers, is intended to take two and a half years, during which occasional reports of progress will be sent home. It is hoped to study the physical geography (including the conditions prevailing during the glacial epoch) of the Tarim basin, with its border of mountains, the Lob Nor and Tsaidam regions. Special attention will also be devoted to the relation of the physical features to the life of the region, especially the human life and history. The route chosen is that through Kashmir to Khotan, whence a tour will be made round the borders of the Tarim basin *viâ* Kashgar and the Turfan depression to Lob Nor, the homeward journey being probably made by way of Tsaidam, Koko Nor, and China.

The Population of China.—Mr. W. W. Rockhill has made an inquiry into the probable population of China, both at various periods in the past, as deducible from Chinese records, and at the present day. The paper, which appeared in the *Smithsonian Miscellaneous Collections* (Quart. Issue, 47, Part 3), has also been issued as a reprint (Washington, December, 1904). In the first section the author discusses the bases of Chinese estimates of population, the number of individuals included in a household, and so on. From a consideration of the comparative care with which various censuses were taken, and the special causes operating as a check or otherwise, he finds that both in the middle of the eighth and the end of the eleventh century the population was not much more than 60,000,000, at the end of the thirteenth not much in excess of 75,000,000, and that during the fifteenth and sixteenth centuries it increased very slowly. In 1651, during the troublous times which accompanied the establishment of Manchu supremacy, it is placed as low as about 55,000,000, while in 1741, the census of which year is thought by Mr. Rockhill to have more closely approximated to the truth than any subsequent ones, it was returned at 143,000,000—a figure probably in excess of the reality. From this time onwards the official figures show the wildest fluctuations,

and from a careful consideration of causes tending in favour of, or against, a rapid increase of population in this period, especially the enormous number of deaths occasioned by droughts and other natural calamities, as well as by wars and rebellions, Mr. Rockhill thinks that the high official estimates are far in excess of the truth, pointing out that, in spite of the many unfavourable conditions, Chinese enumerations would have us believe the increase to be more rapid than in the most favoured countries of the world. In this he agrees with the late Mr. Colborne Baber, whose views, however, are not alluded to in the paper. In 1842 the population was probably about 250,000,000, a figure which cannot be greatly exceeded at the present day; in fact, Mr. Rockhill is inclined to place it considerably under 270,000,000. To the question whether the country is over-populated, he answers in the negative, and even holds that much of it is capable of supporting a greatly increased population, quoting in confirmation of this an opinion of Mr. F. S. A. Bourne.

AFRICA.

The Bed of Lake Rukwa again filled.—It will be remembered that travellers who visited Lake Rukwa during the nineties all reported a great shrinkage in the size of the lake, which even in the height of the rainy season did not appear to cover nearly the whole of its former bed. From a note in a recent number of *Globus* (vol. 87, No. 5, p. 84), it appears that the water-level has lately risen so as to once more fill the whole area. According to statements of Captain von Wangenheim, chief of the Bezirk of Bismarckburg, and of the missionaries Dromaux and Hamberger, the rise in the waters occurred in 1903–4, and the lake now once more bathes the site of Dr. Kayser's grave (near the north end of the depression). It would be possible to travel by boat from the mission station some 10 miles south of this spot to that on the Songwe, a distance of nearly 100 miles. It is hardly to be supposed that this state of things will be permanently maintained, but the facts quoted show that caution is needed in forming the conclusion, from isolated data, that a rapid and progressive desiccation of Central Africa is now taking place, many instances of fluctuations of water-level being probably due to periodic variations of rainfall. It would be of interest to obtain information regarding recent changes of level in the other great African lakes.

AMERICA.

Altitudes in the Canadian Rockies.—Mr. A. O. Wheeler has lately, while conducting a topographical survey of the Selkirk range for the Canadian Government, experimented on the photographic determination of the altitude of four of the great peaks visible from commanding view points in that range, viz. Mounts Columbia, Bryce, Lyell, and Forbes, and he gives the results in *Appalachia* for November, 1904. In order to test the reliability of the method for the computation of altitudes at so great distances (45 to 60 miles), that of Chancellor peak, which had already been fixed trigonometrically at 10,780 feet, was first determined, the mean obtained from four different views being 10,751 feet, or only 29 feet less than the previously obtained result; the range of the four results being only 44 feet. In the case of the four other peaks, the range was much greater—from 235 to 355 feet—the reason being the much greater obliquity of the lines of sight. The mean values obtained were as follows: Mount Columbia, 12,740 feet; Mount Bryce, 11,686 feet; Mount Lyell, 11,463 feet; Mount Forbes, 12,075 feet. These figures confirm the general accuracy of the heights given by Prof. Collie (*Journal*, May, 1903).

Prof. Davis on Glacial Erosion in Colorado.—We last month alluded to a paper by Prof. R. S. Tarr on certain valleys in Central New York, the features

of which seemed, in his opinion, to supply strong arguments against the glacial erosion theory. The opposite view is once more vigorously championed by Prof. W. M. Davis in a paper in *Appalachia* (Boston, November, 1904), in which he describes his observations during a visit, last July, to that portion of the Sawatch range which drains into Twin lakes and thence into the Arkansas. The range has many summits over 14,000 feet high, the culminating point being Mount Elbert, whose domed summit reaches 14,436 feet. During the time spent on the southern slopes of this mountain and in the valley of Lake Creek, excellent local and general views were obtained of much of the area once occupied by the trunk and branch glaciers of the Twin lakes system, the broadly U-shaped trough of Lake Creek having been the channel once occupied by the trunk glacier. Prof. Davis' observations have but confirmed him in his well-known views as to the power of an ice-stream to deepen its valley, though it can hardly be supposed that they would seem equally convincing to a champion of the opposite view. As he himself points out, his case rests, not on any immediate proof of the efficiency of glacial erosion, but on the accordance of the consequences of the purely hypothetical supposition that glaciers do erode, with the facts of observation in glaciated mountain districts. It is hardly to be contested, even by the opponents of the theory, that the facts observed are consistent with great erosive action on the part of ice, could such be proved to be a reality. But it is surely permissible to postpone a definite conclusion until it has been shown that no other agency could possibly be responsible for those facts. Prof. Davis, of course, points to the existence of hanging valleys —a typical example of which was observed by him—in support of his views, and he dismisses as alike insufficient the explanation put forward by M. Kilian, of Grenoble, that they are due to the protective action of the branch glacier; that of Mr. Garwood, who attributes the existing facts to a supposed tilting of the district; and that of Heine, who calls in the greater erosive power of the main than of the side stream. May it not be, however, that, in some cases at least, the discordance of the two valleys may be due to the protective action of the ice, not in the branch, but in the main valley? For it is conceivable that the side valleys may, under special climatic conditions, be progressing towards maturity, while the ice still remains in the main valley and protects the lower portions of its flanks; the upper surface of the ice thus determining, for a time at least, the base-level of the branch valley. Prof. Davis also points out that the Sawatch range repeats the features of other glaciated ranges in the forms of its sharpened peaks and crests, which confirm the view of Richter that the sharpness of various alpine *dents*, *aiguilles*, and *Hörner* is the result of the encroachment of glacial cirques upon formerly dome-like mountains. He suggests that the frequent occurrence of summits about 14,000 feet in height in the Rocky mountains may be due to the destruction of loftier mountains by cirque encroachment. Does not this, however, involve the (no doubt quite legitimate) supposition of a *conservative* action on the part of the glaciers when a certain level, determined by climatic control, is reached?

Reclamation in the Arid Region.—The Reclamation Act, passed on June 17, 1902, has been followed by a striking amount of activity in the direction of surveys and projects for the irrigation of lands at present desert for want of water A large amount of interesting information on the subject is contained in "Water-Supply and Irrigation Paper," No. 93, of the U.S. Geological Survey (Washington, 1904), being a report on the Proceedings of the first Conference of Engineers of the reclamation service, held in Utah in September, 1903. Some of the most striking statements concerning the possibilities in the way of reclamation refer to the state of Idaho, whose agricultural development depends in large measure on the development of irrigation, the reclaimable area being at the same time larger

than in any other state in the arid belt. About 65 per cent. of the surface, or 35 million acres, is arid, and of this arid area the greater part lies within the basin of the Snake river, which must be drawn upon for any supply which may make reclamation possible in this region. It has cut its channel through the great sheet of lava to a depth, in places, of nearly 1000 feet. Thousands of acres have a fertile soil of great depth, and could easily be irrigated if water were brought to them; but the magnitude of the undertaking necessitates the adoption of schemes of comprehensive scope. The surveys already carried out show the entire feasibility of reclaiming about 600,000 acres of desert land, while the total area within the state which it is thought practicable to irrigate is placed at three million acres. In Colorado too energetic steps have been taken, sites for storage reservoirs having been surveyed at points where the valleys are broken and not suited for agriculture. Altogether at least 900,000 acres are capable of being irrigated by this great river. The amount of silt carried down renders the problem a difficult, but probably not an insuperable one. A special project of much interest is one for the diversion of a portion of the water of the Gunnison, through a tunnel 6 miles in length, into the Incompahgre, the valley of which contains some 150,000 acres of most fertile land, for the irrigation of which the Incompahgre itself is quite inadequate. This has necessitated the first precise survey of the grand cañon of the Gunnison, partly traversed by the Denver and Rio Grande railway, but of which the deepest part is in a country unknown to any except hunters, range riders, and exploring engineers. The survey has been carried out since 1900 amid great difficulties, but the result is a valuable addition to geographical knowledge. The river is confined to a channel never more than 300 feet wide from one vertical wall to the other, and falls 800 feet in 4 miles. The bottom of the main cañon is accessible at intervals, but the river can only be crossed at low water. At the proposed dam site it runs through a narrow cut only 40 feet wide.

Negroes in the United States.—According to Bulletin 8 of the U.S. Census Bureau, the negroes in the U.S. (including Alaska and Hawaii) numbered, in 1900, 9¼ millions, a larger number probably than is to be found in any other country outside of Africa. The dark shade of population deepens from north to south, nine-tenths of the total negro population falling to the south states, five-eighths to the lower Mississippi alluvial region, while in Issaquena Co., Mississippi, there are fifteen negroes to each white. The centre of negro population, which in 1790 was in Dinwiddie Co., Va., has now shifted to Dekalb City, Alabama. More than half the negro population live in the coastal plain east of the Mississippi and in the Piedmont region. Whereas in the north and west, negroes constitute about one-fortieth of the city and one-ninetieth of the country population, they constitute in the south one-third of the population, city and country included. In each decade between 1800 and 1840, negroes increased more rapidly than whites, but they have since 1840 been increasing less rapidly. On the other hand, in thirty-eight cities of the United States (thirty-three of them outside the southern states), with at least 100,000 inhabitants, the negroes increased, between 1890 and 1900, by 38 per cent., but the whites only by 32·7 per cent. In the rest of the country the negro population has increased only 16·6 per cent., against 18·7 per cent. of increase in the white population. Whereas the median age of whites is 23·4 years, that of negroes is only 19·4, the difference being connected with the higher birth and death-rate of the negroes. As regards occupation, bread-winners, constituting 37 per cent. of the total white population and 34 per cent. of the southern whites, make up 45 per cent. of the total negro population. Three-fourths of the relatively high percentage of negro bread-winners is accounted for by the marked prevalence of female negro labour, the remainder of the account being ascribable to the fact

that negro boys and negroes over fifty-five years of age are more generally engaged in bread-winning than whites of corresponding ages. Whereas 70 per cent. of male negro workers are engaged in farming, not much more than 40 per cent. of male white workers follow that calling. Outside of farming, negroes are chiefly servants and waiters. Negro clergymen in 1900 numbered 15,528, an increase of 27·7 per cent. on the number in 1890.

AUSTRALASIA AND PACIFIC ISLANDS.

Discovery of Captain Sturt's Diary.—The interesting discovery of the diary, or rather of a portion of the diary, kept by Captain Sturt during his attempt to reach the centre of Australia in 1844–5, was made last year in South Australia. The Rev. John Blackett, who describes the circumstances in the *Proceedings* of the R.G.S. of Australasia (South Australian Branch), vol. 1, 1904, received a letter from an unknown hand, stating that the diary was in the possession of the writer, whose father had been gardener to the explorer during his residence at the Grange. When Captain Sturt left for England, the diary was left behind as rubbish, but was preserved by the gardener's wife. It is, unfortunately, not complete, several pages being missing both at the beginning and end of the book, but it contains the daily record of Sturt's experiences from April 9 to November 10, 1845. It is thus of interest as supplementing the account published in Captain Sturt's book, 'An Expedition into Central Australia,' in the compilation of which it must have been used. The diary, some extracts of which are printed by Mr. Blackett, has been purchased by the Public Library of South Australia.

A Doubtful Island in the Pacific.—In an article bearing this title in the *National Geographic Magazine* (December, 1904), Mr. J. D. Hague discusses the possible existence of a small island in the north-eastern Pacific, between the coast of Mexico and Hawaii, and describes the various searches that have been made for such an island in this locality. It might seem an impossibility that one could exist without having long ago been definitely discovered, but it is pointed out that this part of the Pacific (lying between 15° and 19° N., 132° and 139° W.) is entirely off the regular track of ships. Most of the reports of the existence of land in this region came from whalers in the early part of the nineteenth century, and among the expeditions sent in search of the supposed islands or reefs were those of Captain Beechey in the *Blossom* (1827), and of Sir Edward Belcher with the *Sulphur* and *Starling* (1837). The former passed over the area in question without seeing any of the usual signs of land, while the latter, though making no actual discovery, saw some indications (*e.g.* the presence of the frigate pelican, etc.) which led him to think that some of the reports had been well founded, though the position might have been wrongly given. In 1839, the *Relief*, one of the vessels of the United States Exploring Expedition under Wilkes, took this route in the hope of settling the question, but, though covering more than 15° of longitude between 15° and 17° N., failed to make any discovery. Some faith continued to be placed in the old reports until, in 1899, the Fish Commission steamer *Albatross*, during her cruise with the scientific party under Prof. Agassiz, traversed the doubtful region without seeing any decided signs of land, while soundings gave depths of 2700 fathoms and upwards. In 1902, however, indications of shoal water were observed by Captain Lawless commanding the s.s. *Australia*, of the line running between San Francisco and Tahiti, and this again aroused an interest in the question. The writer of the article under notice had been deeply interested in the fate of the United States sloop-of-war *Levant*, which sailed in 1860 from Hawaii for Panama, but met with disaster in some unknown way, the only indication of its nature being afforded by wreckage found in Hawaii in 1861, which seemed

to show that the ship had been broken in pieces on rocks. The statements of Captain Lawless encouraged him to approach the United States Government on the subject of a further search, with the result that in May, 1904, the *Tacoma*, a newly built cruiser about to make a trial trip to Honolulu under the command of Commander R. F. Nicholson, was directed to visit the locality and seek for traces of the lost *Levant*, Mr. Hague taking part in the voyage. The result was again negative, for though the *Tacoma* cruised over a considerable part of the debatable area, neither land, shoals, nor signs of land were seen. It is pointed out, however, that the existence of a reef or island is not positively disproved, as there still remains an area of some 30,000 square miles not traversed by any of the search expeditions.

POLAR REGIONS.

Peary's New Expedition.—The Peary Arctic Club of New York City has been incorporated for the purpose of aiding Commander Peary in his persistent efforts to complete the geographical conquest of the large unknown area in the North Polar basin, and the members of the club have subscribed more than half of the $150,000 needed to build a ship for the expedition and equip it for the voyage, on which it starts on July 1 next. The vessel, which is to be equipped with both engines and sails, was to be launched about March 1, and is the first ever constructed in the United States for Arctic discovery.

The French Antarctic Expedition.—Some anxiety as to the safety of Dr. Charcot's expedition, which, it will be remembered, went south from Buenos Aires at the end of 1903, has been caused by the return of the Argentine gunboat *Uruguay*, which had been sent in search of the explorers, without having discovered a trace either of ship or men. On making the final start for the Antarctic, Dr. Charcot drew up a programme of his proceedings, mentioning especially the points at which records of his movements would be left, in order to facilitate any search that might become necessary (*Journal*, vol. 23, p. 262). One of these was Wiencke island, at the south-west end of Belgica strait, and this point was reached by the *Uruguay* after an adventurous voyage through masses of heavy ice, but a careful search revealed no record of Dr. Charcot's movements or other trace of his expedition. The Argentine officers express the fear that the *Français* may have been lost in the great storm of April 4, 1904. It does not appear, however, that the *Uruguay* pushed on beyond Wiencke island to the other points chosen by Dr. Charcot for the deposit of records, the turning-point being placed by the telegraphic account in 64° 57′ S. It had been Dr. Charcot's intention to seek winter quarters considerably to the south of this, so that, if it had been possible to push on to Pitt or Adelaide islands (two of the other points at which records were to have been left), a junction might perhaps have been effected with the French party. It may, therefore, be hoped that the explorer may still return north during the next month or six weeks, after which time there would, no doubt, be cause for some disquietude, as Dr. Charcot's expedition was not equipped with a view to spending a second winter in these regions.

Return of Mr. Mossmann.—News has been received in Edinburgh of the safe return to Buenos Aires of Mr. R. C. Mossmann, of the Scottish Antarctic Expedition, who, it will be remembered, remained behind at the meteorological station in the South Orkneys for the purpose of continuing the observations during a second year. He has thus spent two continuous years in the far south.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A Great Globe.—Dr. Marsden Manson, C.E., of San Francisco, has sent us a communication relating to a globe on a scale of 1 : 1,000,000 (42 feet 3 inches in diameter). It is to be so mounted that the globe may have rotatory motions in three directions about its centre, worked by electricity. The globe is to be in a building 60 feet square and 50 feet high, surrounded on three sides by galleries. The fourth side will open to an amphitheatre. Here there will be a lantern with special lenses ground to project on a spherical surface, and so fixed that the axis passes through the centre of the globe. Photographs of the globe, or part of it, will be taken with a camera set up on the lantern stand, and lantern slides showing the distributions of various phenomena will be prepared, and when put into the lantern the proper areas on the globe will be differentially illuminated. With a proper arrangement of light, and the necessary movements of the globe, the phenomena of day and night, the seasons, eclipses, etc., will be graphically illustrated. This description will recall Prof. Reclus's proposal for a great globe (*Geo. Journal*, vol. 12, p. 401), but we believe that the lantern arrangements are new and would form a useful supplement.

The Glacial Period in the Tropics.—The study of phenomena dating from the glacial epoch within the tropics is one of quite recent date. But a few years back our knowledge of such phenomena was virtually non-existent, but though the *data* so far collected are still very imperfect, each year sees some additions to them. Perhaps the most zealous worker in this field has been Dr. Hans Meyer, who has lately extended his researches, begun on Mount Kilimanjaro, to the Andes of Ecuador. The material collected by himself and other travellers justifies the attempt to review it from a comprehensive standpoint, and this was done by Dr. Meyer at the meeting of German naturalists at Breslau in September last, in a paper which has been printed in the *Geographische Zeitschrift* (1904, No. 11). The writer points out that the only regions whence *data* throwing light on former more extensive glaciation in the tropics are likely to be obtained, are the snowy mountains of East Central Africa, the Andes (with their extension into Mexico), and possibly also New Guinea, though our knowledge of the highest mountain chain of the island is at present practically *nil*. Taking the two former regions in turn, Dr. Meyer discusses the present and former levels both of the *névé* (giving the true *climatic* snow-line) and of the glaciers (giving the *orographical* limit of ice). He finds that there is a remarkable general agreement, not only in the existing levels throughout wide regions, but also in the extent to which they fell during the glacial epoch. The general result is to show that in the later glacial age the tropical mountain ranges were subject to an increased glaciation, the maxima of which were, in some localities at least, separated by an inter-glacial period, the earlier maximum being the more pronounced of the two. The depression of the *névé*-line during the ice age may be placed at about 500–600 metres (1650–2000 feet) within the tropics, the amount of the difference increasing regularly towards the poles. The conclusion is drawn that this symmetrical arrangement of the line of *névé* over the whole world, and the equality in the extent of its depression during the ice age in homologous climatic zones, indicate that the glacial phenomena were contemporaneous over the whole world, and disprove alike the idea that former more extensive glaciation may have been due to local causes, and the view that there was an alternation between the glaciations of the northern and southern hemispheres. The probability is that we must rather ascribe the phenomena, with Brückner, to long-period variations in the amount of the sun's heat.

GENERAL.

A New Honour for Captain Scott.—To the list of honours already bestowed on Captain Scott in recognition of his services to Antarctic discovery, must now be added the gold medal of the Swedish Geographical Society, which, we are informed by its president, Dr. Sven Hedin, was awarded to the explorer at a recent meeting.

The Successor to Ratzel.—We are pleased to learn that Prof. J. Partsch has been chosen to fill the chair of geography at Leipzig, vacant by the death of Friedrich Ratzel. Prof. Partsch was born on July 4, 1851, at Schreiberhau, in the Silesian Riesengebirge, and studied philology under Herz, and history and geography under Karl Neumann. In 1884 he became ordinary professor of geography in the university of Breslau. Originally a student of geography in its historic aspect, he became in time a master of the subject also in relation to modern natural science, and his published works coincide with the course of development of his own studies. The chief of them are as follows: 'Die Darstellung Europas in dem Geographischen Werke des Agrippa' (1875); 'Physikalische Geographie von Griechenland mit besonderer Rücksicht auf das Altertum' (1885), based on Karl Neumann's lectures; 'Philipp Clüver, der Begründer der historischen Länderkunde' (1891); 'Die Gletscher der Vorzeit in den Karpaten und den Mittelgebirgen Deutschlands' (1882); 'Die Vergletscherung des Riesengebirges zur Eiszeit' (1894). This last work has been supplemented by investigations concerning the ice age in the whole area between the regions of northern and of Alpine ice, published in separate works since 1903. His mastery of geographical description is shown in his monographs on the Ionian islands (1888–99), in his 'Schlesien' (Bd. 1, 1896); and, last not least, in his 'Mitteleuropa' (English and German, 1903–4).

Baron Toll.—At the annual meeting of the Academy of Sciences at St. Petersburg, Prof. S. T. Oldenburg, who read the yearly report of the Physical and Mathematical Section of the Academy, opened his address with the following words: "To-day I must unfortunately announce, on behalf of the Polar Committee, that the last hope of seeing the valiant travellers, Baron Edward Toll and F. G. Seeberg, return to us must be given up. Baron Toll and his companions perished in the gloom of the Arctic night, on their way across the immense, ever-moving ice-fields, intersected by open spaces and covered with high ice-hummocks, which float between Bennett island and the archipelago of New Siberia. New victims have thus been added to those who have already perished in the desire to tear aside the veil which hides the unknown pole. They have perished, but they have left us a rich inheritance of varied and precious scientific materials, which, we hope, will soon be published, and will be the best monument we can erect to their memory."

The Invention of the Compass.—Several articles have of late appeared in Italy on this subject. It seems certain that the needle was first used in navigation by the mariners of Amalfi sometime in the eleventh or twelfth centuries or a little earlier, but the inventors are unknown. Last year a paper was read at the Fifth Italian Geographical Congress by Dr. L. Posteraro, of Naples, the chief object being to prove that the credit of making the first step in turning the magnetic needle to practical purposes is due to Salomone Ireneo Pacifico of Verona (778–846 A.D.). A somewhat obscure epitaph on his tomb in the cathedral of Verona, in which the invention of a *horologium nocturnum* is ascribed to him, is interpreted by Dr. Posteraro to mean that Pacifico applied the needle to a *scaphion*, a bowl carrying a gnomon, which was used as a dial and also frequently

as an azimuthal instrument. In sunshine the instrument was set to the points of the compass by the shadow of the gnomon, and if the direction of the north pole were ascertained by the magnetic needle, it could be used to determine angles at night. If such were the invention of Pacifico, it is the earliest known application of the needle as a directive instrument.

The German Colonies.—The Foreign Office Report on the German colonies for 1902–3 (No. 3296) (Annual Series) quotes from the Imperial Chancellor's Memorandum, December, 1903, that, while unmistakably progressing, the colonies yet progress at a slower rate than is desirable. Outside East Africa and the Cameroons, labour continues a problem in Samoa, though it has been met by the importation of Chinese coolies. South-West Africa has, of course, caused the greatest anxiety, and it has been estimated that the Herero rebellion will in the end cost the imperial treasury £2,500,000. What with the return of the Boers to their own country and the departure of workmen engaged on the railway to Windhoek and the Swakopmund pier, the white population on January 1, 1903, was but eight more than a year earlier, or 4682 in all, including 453 British, an increase of one only. The railway receipts, 1902–3, were £44,349, the working expenses £66,768, while £30,000 has been voted for repair of the damage done by the Hereros. The pier, again, has since its opening on February 12, 1903, suffered so seriously from the impact of the sea and silting that the Colonial Press recurs to the idea of the acquisition of Walfish bay by exchange or otherwise. The Otavi railway, provided for in the mining concession, is to run direct from Swakopmund to Otavi district, a length of 354 miles. Begun in the autumn of 1903, it was to be finished in two and a half years, but the work has been interrupted by the rising. The total trade of the German colonies, imports and exports, in 1902–3, amounted to £3,140,000, an increase of £344,000 as compared with 1901–2, representing a gain of more than one-third in four years. While the imports in these four years had risen by but 30 per cent., the exports had increased by 55 per cent. The total colonial trade during 1902–3 increased, moreover, in spite of the fact that, in consequence of the cessation of large public works, such as harbours and railways, the imports on Government account were considerably diminished. Kiau-Chau is specially dealt with, but as it is the subject of a separate note (*ante*, p. 211), there is the less occasion to refer to it here. Since its occupation Kiau-Chau has cost the imperial treasury almost as much per annum (£612,000) as all the other German colonies together, but by way of compensation, the advance has been most striking. To German occupation are due an excellent inner harbour, a whole quarter of European villas, two new Chinese towns, and a large hotel. Its trade in 1902–3 was double that of 1901–2.

A Photographic Pocket-book.—Messrs. Burroughs, Wellcome & Co. have just published the 1905 edition of their useful little photographic pocket-book for travellers, 'Wellcome's Photographic Exposure Record and Diary.' In addition to the information generally given, which has become familiar to many, and which has now been thoroughly revised, several important alterations and additions have been made. The monthly light tables, hitherto printed amongst the diary tables, are now transferred to a special section at the end of the book. They are so arranged that light tables face the exposure calculator. As each month goes by its light table is removed, like the leaves of a calendar, and the light table for the following month is in its place. By this arrangement the opening of the book at the end gives at a glance on the left-hand page the light value for the time of year, day, hour, and atmospheric condition, whilst a single turn of the scale of the calculator on the right-hand side settles what exposure to give for any subject and with any plate. Other improvements have been made in the diary, and more space

is given for each record. The article on exposure gives complete instructions for using the calculator provided, and those desirous of obtaining information on the subject of exposure generally cannot do better than carefully read this chapter.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904–1905.

Sixth Meeting, February 13, 1905.—Colonel Sir T. H. Holdich, K.C.I.E., etc., Vice-President, in the Chair.

Elections.—*Lieut. Robert Corbett Bayldon, R.N.; Colonel W. B. Capper, Director of Military Education, India; Thomas Garby Davey, F.G.S.; Ralph Jackson Davies-Colley; Robert Wilfred Hannam; C. A. W. Monckton; Joseph David Dallin Paul, M.A.; Captain Lee Oliver Fitzmaurice Stack; Alexander Taylor; Henry Franklin Yeo.*

The paper read was:—

"The Geographical Results of the Tibet Mission." By Sir Frank Younghusband, K.C.I.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *G.Z.* 10 (1904): 569–578. Brückner.
Die Eiszeiten in den Alpen. Von Prof. Dr. E. Brückner.

Alps. *Vierteljahrs. Naturforsch. Ges. Zürich* 49 (1904): 159–170. Rollier.
Die Entstehung der Molasse auf der Nordseite der Alpen. Von L. Rollier.

Alps. **Sennett.**
Across the Great Saint Bernard. The Modes of Nature and the Manners of Man. By A. R. Sennett. London: Bemrose & Sons, 1904. Size 8½ × 5½, pp. xvi., 444, and 100. *Illustrations. Price 6s. net. Presented by the Publishers.*

Will no doubt serve its purpose of putting before stay-at-home readers an agreeable picture of Alpine scenery and Swiss life. Some attempt at instruction on the natural phenomena of mountain regions, in popular form, is also made. We notice that the author appears to have no doubt that Hannibal's crossing was by the great St. Bernard.

Baltic Sea—Fisheries. **Petersen and Others.**
Conseil Perm. Internat. Explor. Mer. Publ. Circonstance, No. 13a (1904): pp. 58.
Die Ostsee-Fischerei in ihrer jetzigen Lage (Erster Teil). I. Uebersicht über die Seefischerei in den dänischen Gewässern innerhalb Skagens im Auftrag von Dr. C. G. J. Petersen bearbeitet von A. Otterström. II. Uebersicht über die Seefischerei Schwedens an den süd- und östlichen Küsten dieses Landes bearbeitet von Dr. F. Trybom und A. Wollebæk. *With Maps and Plates.*

Belgium. *B.S.R. Belge G.* **28** (1904): 206–224, 295–310, 358–378. **Cornet.**
Excursions de géographie physique en Flandre et en Hainaut. Par J. Cornet.

France. *Questions Dipl.* **18** (1904): 1–10, 91–105, 160–178, 220–234, 273–287. **Laffitte.**
L'expansion économique de la France. Par Prof. L. Laffitte. *With Maps and Plans.*

Takes the various regions in turn and discusses the present conditions and proposed development of lines of communications and the like.

France. *La G., B.S.G. Paris* **10** (1904): 287-294. **Mougin.**
Les poches intraglaciaires du Glacier de Tête-Rousse. Par P. Mougin. *With Maps and Illustrations.*

France—Brittany. *Tour du Monde* **10** (1904): 409–492. **Geffroy.**
La Bretagne du Sud. Par G. Geffroy. *With Illustrations.*

France—Brittany. *Ann. G.* **13** (1904): 296-309. **Robert.**
La densité de la population en Bretagne calculée par zones d'égal éloignement de la mer. Par E. Robert. *With Map.*

France—Corsica. *Ann. G.* **13** (1904): 334–347. **Vanutberghe.**
La Corse, étude de géographie humaine. Par H. Vanutberghe.

France—Hautes Alpes. *C. Rd.* **139** (1904): 434–436. **Martel.**
Sur l'*Oucane* de Chabrières (Hautes-Alpes) et l'origine des lapiaz. Note de E. A. Martel.

The subject of this note is a field of "karren" defined by two series of intersecting chasms, the characteristics of which seem to confirm M. Martel's views on the origin of such features (cf. *Journal*, vol. 21, p. 328).

Germany. *M.V. Erdk. Halle a. S.* (1904): 1–53. **Gerbing.**
Die Pässe des Thüringerwaldes in ihrer Bedeutung für den innerdeutschen Verkehr und das deutsche Strassennetz. Von W. Gerbing. *With Map.*

Germany. *M.V. Erdk. Halle a. S.* (1904): 79–83. **Halbfass.**
Ueber Einsturzbecken am Südrand des Harzes. Von Prof. Dr. W. Halbfass. *With Maps.*

Germany. *Naturw. Wochenschrift* **3** (1904): 865–871. **Stille.**
Die geologischen Linien im Landschaftsbilde Mitteldeutschlands. Von Dr. H. Stille. *With Sketch-map.*

Germany. *Z. Ges. Erdk. Berlin* (1904): 651-659. **Ule.**
Alter und Entstehung des Würm-Sees. Von Prof. Dr. W. Ule. *With Maps.*

See note in the Monthly Record for February (p. 210).

Germany—Historical. **Detlefsen.**
Die Entdeckung des germanischen Nordens im Altertum. Von D. Detlefsen. (Quellen und Forschungen zur alten Geschichte und Geographie, herausgegeben von W. Sieglin, Heft 8.) Berlin: Weidmannsche Buchhandlung, 1904. Size 10 × 6½, pp. 66.

Germany—Pomerania. *Petermanns M.* 50 (1904): 253-259. **Halbfass.**
Weitere Beiträge zur Kenntnis der pommerschen Seen. Von Prof. Dr. W. Halbfass. *With Maps.*

Germany—Thüringerwald. *M.V. Erdk. Halle a. S.* (1904): 88-90. **Gerbing.**
Die Verbreitung des Loiba-Namens im Thüringerwald. Von L. Gerbing.

Defines the area over which traces of the old name "Loiba" for the Thüringerwald are still met with in place-names, as well as the period during which it appears in literature.

Germany—Waterways. *Contemporary Rev.* 86 (1904): 778-797. **Eltzbacher.**
The Lesson of the German Waterways. By O. Eltzbacher.

Holland. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 21 (1904): 941-972. **Bruyn.**
Proeve van verklaring der temperatuur-anomalieën in den St. Pietersberg bij Maastricht. Door F. de Bruyn, S.J.

Holland. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 21 (1904): 1080-1089. ——
De Utrechtsch-Noordhollandsche Vecht. Door A. A. B.

The Vecht is part river, part basin, and was originally a side branch of the Rhine.

Holland—Hydrology. *K.A.W. Amsterdam, P. Sec. Sci.* 6 (1904): 738-760. **Dubois.**
Facts leading to trace out the motion and the origin of the underground water in our sea-provinces. By Prof. E. Dubois.

Holland—Place-names. **Kern.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 21 (1904): 773-786.
Iets over de oudstbekende aardrijkskundige namen in Nederland. Door Prof. Dr. H. Kern.

Italy—Sicily. **Sladen.**
Sicily, the new Winter Resort, an Encyclopædia of Sicily. By Douglas Sladen. London: Methuen & Co., [1905]. Size 8 × 5½, pp. xxiv. and 616. *Map and Illustrations. Price 5s. net. Presented by the Author.*

United Kingdom—Goodwin Sands. **Gattie.**
Memorials of the Goodwin Sands, and their Surroundings, Legendary and Historical. By G. B. Gattie. London: J. J. Keliher & Co., 1904. Size 8 × 5½, pp. xvi. and 298. *Maps, Charts, and Illustrations.*

Describes in an interesting way the present features, past changes, and historical associations of the region of the Goodwin Sands, with notes on various schemes set on foot in the interest of safe navigation.

United Kingdom—Wales. **Pritchard.**
Cardigan Priory in the Olden Days. By Emily M. Pritchard. (Olwen Powys.) London: W. Heinemann, 1904. Size 10½ × 8, pp. xiv. and 168. *Map and Illustrations. Presented by the Author.*

This work is evidently the outcome of much careful study of old records. Its interest is mainly antiquarian, but it includes the reproduction of Blaeu's map of Cardiganshire, made from a copy which, the author writes, seems to be an earlier impression than those usually found in the 'Atlas.' The representation of Cardigan priory church (of which an enlargement is given) leads her to suppose, from its resemblance to descriptions of the church as it existed in the sixteenth century, that the draughtsman was possessed of local knowledge. From what we know of the care taken by Blaeu in the collection of his material, this is quite possible, but it is to be remarked that the representations of cities with their churches show a great general resemblance throughout the atlas, while the one in question differs considerably from the drawing of Cardigan in Speed's atlas at a somewhat earlier date.

ASIA.

China. *Globus* 86 (1904): 217-218. **Reitzenstein.**
Die Silberinsel bei Chinkiang. Von Frh. v. Reitzenstein. *With Maps and Illustration.*

China. **Brown.**
From Tientsin to Peking with the Allied Forces. By the Rev. F. Brown. London: C. H. Kelly, 1902. Size 7½ × 5, pp. 126. *Illustrations. Price 1s. 6d. Presented by the Author.*

China. **Hackmann.**

Vom Omi bis Bhamo. Wanderungen an der Grenzen von China, Tibet und Birma. Von Lic. H. Hackmann. Halle a. S: Gebauer-Schwetschke, 1905. Size 9 × 7, pp. 382. *Maps and Illustrations. Price* 8*s*.

The author made the journey from Ta-chien-lu to Bhamo by routes through southwest Se-chuan, differing somewhat from those of Baber, Hosie, Jack, and others. The book is illustrated in a somewhat novel fashion, the margins being occupied by sketches of various kinds, which, though at first sight appearing somewhat fanciful, are said to all represent actual objects or scenes of the country passed through. The map is roughly drawn, and the courses of the rivers are not always shown with accuracy.

China. **Hourst.**

Seconde Mission Hourst. Dans les rapides du Fleuve Bleu. Voyage de la Première Canonnière Française sur le haut Yang-Tse-Kiang, par le Lt. de Vaisseau Hourst. Préface de M. Jules Lemaitre. Paris: Plon-Nourrit et Cie., 1904. Size 9 × 6, pp. 368. *Map and Illustrations. Price* 7*s*. 6*d*.

A popular account, by the well-known explorer of the Niger, of the survey work on the Yangtse, of which some account was given in the *Journal* for August, 1903 (vol. 22, p. 211).

China—Sechuan. *La G., B.S.G. Paris* 10 (1904): 317–320. **d'Anty.**

Explorations dans le Sseu-Tch'ouan. Par P. Bons d'Anty.

See note in the Monthly Record for February (p. 211).

China—Shantung. *Petermanns M.* 50 (1904): 251–253. **Anz.**

Aus dem zentralen Gebirgsland der Provinz Schantung. Von W. Anz. *With Map.*

China—Shantung. *Z. Kolonialpolitik* 6 (1904): 570–667. **Berensmann.**

Wirtschaftsgeographie Schantungs unter besonderer Berücksichtigung des Kiautschougebiets. Von Dr. Berensmann.

Noticed in the Monthly Record for February (p. 211).

China—Yunnan. **Courtellemont.**

Gervais Courtellemont. Voyage au Yunnan. Paris: Plon-Nourrit et Cie., 1904. Size 7½ × 5, pp. xiv. and 298. *Map and Illustrations. Price* 3*s*.

The journey was alluded to in the December number (vol. 24, p. 676). The book is well illustrated from photographs, and besides a small outline-map of Indo-China, there is a sketch of the bend of the Yangtse near Li-kiang.

Chinese Empire—Tibet. **Candler.**

The Unveiling of Lhasa. By E. Candler. Second Impression. London: E. Arnold, 1905. Size 9¼ × 6, pp. xvi. and 304. *Map and Illustrations. Price* 15*s*. *net. Presented by the Publisher.*

Chinese Empire—Tibet. ——

East India (Tibet). Further Papers relating to Tibet. No. III. London: Wyman & Sons, 1905. [Cd. 2370.] Size 13 × 8¼, pp. xxvi. and 278. *Price* 2*s*. 5*d*.

Chinese Empire—Tibet. *Tour du Monde* 10 (1904): 217–240. **Narzounof.**

Trois voyages à Lhassa (1898–1901). Par O. Narzounof, pèlerin Kalmouk. *With Map and Illustrations.*

Eastern Asia. **Schön.**

Der Kriegsschauplatz in Ostasien. Geographische Beschreibung und Würdigung. Von Major J. Schön. Zweite Auflage. Berlin und Leipzig: F. Luckhardt, 1904. Size 9¼ × 6¼, pp. 310. *Maps. Price* 5*s*.

A detailed geographical description of the present theatre of war.

India. **Gore.**

Survey of India. Professional Paper—No. 1 (second edition). On the Projection for a map of India and adjacent Countries on the scale of 1 : 1,000,000. By Colonel St. G. C. Gore, C.S.I. Dehra Dun, 1903. Size 11 × 8½, pp. 10. *Index Map.*

Describes the modified secant conical projection which it has now been decided to use instead of the ordinary one originally proposed.

India—Baltistan. *M.K.K.G. Ges. Wien* 47 (1904): 247–260. **Pfannl.**

Von meiner Reise zum K_2 in den Bergen Baltistans. Von Dr. H. Pfannl.

The writer was a member of the Eckenstein expedition.

India—Jammu. *Mem. Geolog. Surv. India* 32 (1904): 189-263. **Simpson.**
Report on the Jammu Coal-fields. By R. R. Simpson, B.SC. *With Map and Plates.*
See note in the February number (p. 210).

India—Kashmir. *Records Geolog. Surv. India* 31 (1904): 142-161. **Oldham.**
Note on the Glaciation and History of the Sind Valley, Kashmir. By R. D. Oldham. *With Plates.*

India—Mount Everest. *Nature* 71 (1904): 42-46. **Burrard.**
Mount Everest: the story of a long Controversy. By Major S. G. Burrard, F.R.S.
A brief reply by Mr. Freshfield appeared in the next number of *Nature.*

India—Seismology. *Mem. Geolog. Surv. India* 35 (Pt. 3) (1904): pp. 42. **Ballore.**
The Seismic Phenomena in British India, and their connection with its Geology By Count F. de Montessus de Ballore. *With Maps.*

Japan. **Sladen and Lorimer.**
More Queer Things about Japan. By D. Sladen and N. Lorimer. To which are added "The Letters of Will Adams," written from Japan, 1611-1617, reprinted by special permission from the papers of the Hakluyt Society; and "A Life of Napoleon," written and illustrated by Japanese in the first half of the nineteenth century. London: A. Treherne & Co., 1904. Size 9 × 6, pp. xl. and 484. *Illustrations. Presented by the Publishers.*

AFRICA.

British West Africa. **George.**
The Rise of British West Africa, comprising the early history of the Colony of Sierra Leone, the Gambia, Lagos, Gold Coast, etc. With a brief account of Climate, the Growth of Education, Commerce, and Religion, and a comprehensive history of the Bananas and Bance Islands and sketches of the constitution. By C. George. London: Houlston & Sons, 1903. Size 9 × 6, pp. x. and 468. *Price* 12*s. net. Presented by the Publishers.* [To be reviewed.]

East Africa. *Z. Ges. Erdk. Berlin* (1904): 522-523. **Uhlig.**
Von der Ostafrikanischen Expedition der Otto Winter-Stiftung. Mitteilung des Leiters der Expedition, Prof. Dr. C. Uhlig.
Cf. note in the January number (p. 92).

East Africa—Europa Island. *Z. Ges. Erdk. Berlin* (1904): 426-451. **Voeltzkow.**
Berichte über eine Reise nach Ost-Afrika zur Untersuchung der Bildung und des Aufbaues der Riffe und Inseln des westlichen Indischen Ozeans. Von Prof. Dr. A. Voeltzkow. V. Europa-Insel. *With Map. Also separate copy, presented by the Author.*

Egypt. **Garstin.**
Public Works Ministry. Report upon the Administration of the Public Works Department in Egypt for 1903. By Sir W. Garstin, G.C.M.G. Cairo, 1904. Size 11 × 7½, pp. 430. *Plans and Diagrams.*

Egypt. *Z. Ges. Erdk. Berlin* (1904): 574-593. **Schweinfurth.**
Die Umgegend von Schaghab und el-Kab (Ober-Ägypten). Von Prof. Dr. G. Schweinfurth. *With Maps and Illustrations.*

Egypt—Anthropology. **Chantre.**
Recherches anthropologiques dans l'Afrique Orientale: Égypte. Par E. Chantre. Lyon: A. Rey & Cie., 1904. Size 15 × 11½, pp. xviii. and 318. *Illustrations. Presented by the Author.* [To be reviewed.]

Egypt—Anthropology. **Chantre.**
Société d'Anthropologie de Lyon. Les Soudanais orientaux émigrés en Égypte. Esquisse ethnographique et anthropométrique. Par E. Chantre. Lyon: A. Rey & Cie., 1904. Size 9 × 6, pp. 48. *Illustrations.*

Eritrea. *L'Esploraz. Com.* 19 (1904): 232-241. **Belloni.**
Da Barentù al Setit, o a Godofelassi. Note di viaggio. Tenente G. Belloni.

Eritrea. **Kaiser.**
Die Kolonie Eritrea und ihre Besiedelung durch die Italiener. Von A. Kaiser. (Separatabdruck aus den "Mitteilungen der ostschweizerischen geographisch-commerziellen Gesellschaft St. Gallen," 1904.) Size 9 × 6¼, pp. 20.

French West Africa. *Rev. Colon.* (1904): 141-143. **Desplagnes.**
Découverte des ruines de Koukiya, rapport du lieutenant Desplagnes.
See note in the Monthly Record for February (p. 215).

German East Africa. *Deutsch. Kolonialblatt* 15 (1904): 527-533. **Schleinitz.**
Bericht des Hauptmanns Freiherrn v. Schleinitz über seine Reise durch das Massaigebiet von Ikoma bis zum ostafrikanischen Graben im März 1904. *With Map.*
Journey through the districts north of Lake Eyassi.

German East Africa. *Deutsch. Kolonialblatt* 15 (1904): 533-535. ——
Der Bau der Strasse Niassa—Tanganjika.
Describes the road now being made through German territory between Nyasa and Tanganyika.

Gold Coast. *J. African S.* 4 (1904): 1-43. **Nathan.**
The Gold Coast at the end of the Seventeenth Century under the Danes and Dutch. *With Illustration.* Historical Chart of the Gold Coast and Ashanti. By Major Sir M. Nathan, K.C.M.G.

Italian Somali Coast. *L'Esporoz. Com.* 19 (1904): 305-313. **Vigoni.**
Per il Benadir. P. Vigoni.

Morocco. *Archiv. Marocaines* 1 (1904): 301-365. **Besnier.**
Géographie ancienne du Maroc (Maurétanie Tingitane). Par M. Besnier. *With Map.*

Morocco. *Archiv. Marocaines* 2 (1904): 1-99. **Salmon.**
Essai sur l'histoire politique du nord-marocain. Par G. Salmon.

Natal and Zululand. **Anderson.**
Natal. Surveyor-General's Department. Second Report of the Geological Survey of Natal and Zululand. By W. Anderson, Government Geologist. London: West, Newman & Co., 1904. Size 12 × 8½, pp. 170. *Maps and Plates. Presented by the Geological Survey of Natal.*

Nigeria. **Partridge.**
Cross River Natives, being some notes on the primitive Pagans of Obubura Hill District, Southern Nigeria, including a description of the circles of upright sculptured stones on the left bank of the Aweyong River. By C. Partridge. London: Hutchinson & Co., 1905. Size 9 × 6, pp. xvi. and 332. *Maps and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*
Miscellaneous notes on the people of a district about which very little has hitherto been written. The numerous photographs will be valuable to ethnologists.

North-East Africa. *La G., B.S.G. Paris* 10 (1904): 295-299. ——
Les communications entre Djibouti et Addis-Abeba. *With Map and Profile.*

Rhodesia. *P. Rhodesia Sci. Assoc.* 2 (1901): 5-28. **Hall and Neal.**
Architecture and Construction of Ancient Ruins in Rhodesia. By R. M. Hall and W. G. Neal.

Rhodesia. *P. Rhodesia Sci. Assoc.* 1 (1899-1900): 7-9. **Molyneux.**
Notes on some Rock Paintings in the Tuli District. By A. J. C. Molyneux. *With Plates.*

Rhodesia—Climate. *P. Rhodesia Sci. Assoc.* 2 (1901): 48-53. **Nicot**
Some features of our climate. By Rev. F. Nicot, S.J.

Rhodesia—Hot Springs. *P. Rhodesia Sci. Assoc.* 3 (1902): 9-20. **Ferguson**
The Geysers or Hot Springs of the Zambesi and Kafue Valleys. By D. Ferguson.

Rhodesia—Ruins. *P. Rhodesia Sci. Assoc.* 1 (1899-1900): 11-18. **White.**
On the Khami Ruins, near Bulawayo. By F. White. *With Plates.*

Somaliland. *J. African S.* 4 (1904): 91-108. **Kirk.**
The Yibirs and Midgâns of Somaliland, their traditions and dialects. By Lieut. J. W. C. Kirk.

South Africa. **Henkel.**
History, Resources and Productions of the country between Cape Colony and Natal, or Kaffraria Proper, now called the Native or Transkeian Territories. Compiled and illustrated by C. C. Henkel, J.P. Hamburg; London: Effingham Wilson, 1903. Size 10½ × 7½, pp. 124. *Map and Illustrations.*
The author was formerly conservator of forests in the Transkeian territories.

Sudan. *M. Seminars Orient. Sprachen* 7 (1904) (*Afrikan. Studien*) 263–269. **Bülow.**
Bericht über politische Verhältnisse im mittleren Sudan. Von von Bülow.

Sudan. *Petermanns M.* 50 (1904) : 210–216. **Passarge.**
Zur Oberflächengestaltung von Kanem. Von Dr. S. Passarge.

Togo. *Deutsch. Kolonialblatt* 15 (1904): 487–488. **Seefried.**
Bericht des Oberleutnants Freiherrn v. Seefried über die Untersuchung des Hahoflusses. *With Map.*

Transvaal. *T. Geolog. S. South Africa* 7 (1904): 51–56. **Holmes.**
Some Notes on the Geology of the Northern Transvaal. By G. G. Holmes. *With Map and Sections.*

Transvaal. *T. Geolog. S. South Africa* 7 (1904): 18–26. **Mellor.**
On some Glaciated Land Surfaces occurring in the District between Pretoria and Balmoral, with Notes on the Extent and Distribution of the Glacial Conglomerate in the same area. By E. T. Mellor.

See note in the December number (p. 679).

Tripoli. *Nouv. Archiv. Miss. Sci.* 12 (1904): 1–80. **Mathuisieulx.**
Rapport sur une Mission Scientifique en Tripolitaine. Par H. Méhier de Mathuisieulx. *With Map and Plates.*

The full report on the writer's second scientific mission to Tripoli in 1903 (cf. *Journal*, vol. 22, p. 700).

NORTH AMERICA.

Canada—British Columbia. **Morice.**
The History of the Northern Interior of British Columbia (formerly New Caledonia) [1660 to 1880]. By the Rev. A. G. Morice. Toronto: W. Briggs, 1904. Size 9½ × 6, pp. xii. and 350. *Map and Illustrations. Price* $2.50. *Presented by the Author.*

A valuable addition to our knowledge of the early history of British Columbia, based largely on original documents preserved at Fort St. James, Stuart lake.

Canada—Geological Survey. ———
Geological Survey of Canada. Annual Report (New Series), vol. xiii, 1900. Ottawa, 1903. Size 10 × 6½. *Maps (separate) and Illustrations. Presented by the Geological Survey of Canada.*

Includes the summary report for the year and a number of special reports, each paged separately, which have all been issued previously.

Canada—Hudson Bay. **Low.**
Ann. Rep. Geol. Surv. Canada 13, 1900 (1903) : Reports D and DD, pp. 84 and 31.
On an Exploration of the East Coast of Hudson Bay from Cape Wolstenholme to the South End of James Bay. By A. P. Low. *Maps.*
On the Geology and Physical Character of the Nastapoka islands, Hudson bay. By the same. *Plates.*

Canada—New Brunswick. **Bailey and Poole.**
Ann. Rep. Geol. Surv. Canada 13, 1900 (1903): Reports M and MM, pp. 38, 26.
Upon the Carboniferous System of New Brunswick, with special reference to the workable coal. By L. W. Bailey.
On the coal prospects of New Brunswick. By Henry S. Poole.

Canada—Quebec. **Bell.**
Ann. Rep. Geol. Surv. Canada 13, 1900 (1903): Report K, pp. 11.
On the geology of the basin of the Nottaway river. By Robert Bell. *Map.*

Canada—St. Lawrence. *B. American G.S.* 36 (1904): 449–466. **Semple.**
The Influence of Geographic Environment on the Lower St. Lawrence. By E. C. Semple.

Mexico. *Mem. y Rev. S. Ci.* "*Antonio Alzate*" 20 (1903): 73–81. **Aleman.**
Observaciones de latitud en Apam practicadas por la Comisión Geodésica (Método de Talcott). Por S. Aleman.

Mexico. *Mem. y Rev. S. Ci.* "*Antonio Alzate*" 18 (1902): 159–184. **Böse.**
Sur les régions des tremblements de terre au Mexique. (Avec résumé en allemand.) Por Dr. E. Böse. *With Maps.*

Mexico. *Mem. y Rev. S. Ci.* "*Antonio Alzate*" 18 (1902): 267–270. **Böse.**
Breve noticia sobre el estado actual del Volcán de Tacaná (Chiapas). Por el Dr. E. Böse. *With Plate.*

Mexico. *Mem. y Rev. S. Ci.* "*Antonio A'zate*" 19 (1903): 137–157. **Moreno y Anda.**
El decrecimiento de la temperatura con la altitud. Por M. Moreno y Anda.

Mexico. *National G. Mag.* 15 (1904): 341–356. **Nelson.**
A Winter Expedition into South-Western Mexico. By E. W. Nelson. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

Brazil and Bolivia—Boundary. ———
Brazil and Bolivia Boundary Settlement. Treaty for the Exchange of Territories and other Compensations signed at Petropolis, November 17, 1903, together with the Report of Baron Rio Branco. New York: The Knickerbocker Press, [1904]. Size 9½ × 6, pp. 44. *Maps.*

Cf. *Journal*, vol. 23, p. 596 *et seq.*

Chile and Argentine Republic. ———
Memoria Sobre la Demarcacion Arbitral de Limites entre Chile i la República Arjentina. Santiago de Chile, 1903. Size 11 × 8, pp. 84. *Maps.*

Colombia. *B.R.S.G. Madrid* 46 (1904): 266–271. **Arroyo.**
República de Colombia; las comunicaciones y el comercio. Por J. Maria del Arroyo.

French Guiana. **Marcel**
Un texte ethnographique inédit du XVIII^e siècle. Par G. Marcel. (Extrait du *Journal de la Société des Américanistes de Paris*, tome 1^er, numero 2.) 1904. Size 11 × 7½, pp. 22. *Presented by the Author.*

The manuscript here described was written by a French doctor named La Croix towards the end of the eighteenth century. It describes his travels, and includes a chapter on the Indians of Guiana.

Grenada. ———
The Grenada Handbook, Directory and Almanac for the year 1905. Compiled by the Colonial Secretary. London: Low & Co. [E. Stanford], 1905. Size 7½ × 5, pp. viii. and 188. *Illustration. Price 1s. 6d. net. Presented by Mr. E. Stanford.*

This useful handbook includes a descriptive sketch of the colony, an official directory, statistical summary, and much other practical information.

Guatemala and Salvador. *Petermanns M.* 50 (1904): 203–210. **Sapper.**
Neue Beiträge zur Kenntnis von Guatemala und Westsalvador. Von Prof. Dr. K. Sapper. *With Maps.*

Intercontiental Railway. *B. American G.S.* 36 (1904): 466–470. ———
The Pan-American Railway. *With Map.*

Based on the official report.

Martinique. **Heilprin**
The Tower of Pelée. New Studies of the Great Volcano of Martinique. By A. Heilprin. Philadelphia and London: J. B. Lippincott Company, 1904. Size 12½ × 9½, pp. 62. *Plates. Presented by the Publishers.*

Patagonia. *B.R.S.G. Madrid* 46 (1904): 218–246. **Milanesio.**
La Patagonia: Conferencia dada por el misionero salesiano R. P. Domingo Milanesio.

Peru. *Petermanns M.* 50 (1904): 267–270. **Benrath.**
Ueber eine Eiszeit in der Peruanischen Küstenkordillere. Von Dr. A. Benrath.

Peru. *B. Cuerpo Ingen. Minas Peru*, No. 12 (1904): pp. 28. **Steinmann.**
Observaciones Geológicas de Lima á Chanchamayo. Por el Dr. G. Steinmann. *With Profiles.*

Peru. **Von den Steinen.**
Diccionario Sipibo. Castellano—Deutsch—Sipibo. Apuntes de Gramática Sipibo —Castellano, Abdruck der Handschrift eines Franziskaners mit Beiträgen zur Kenntnis der Pano-Stämme am Ucayali, herausgegeben von K. von den Steinen.

Berlin: D. Reimer (E. Vohsen), 1904. Size 11½ × 8, pp. 40 and 128. *Presented by the Author.*

The manuscript from which this has been printed was found in 1884 by R. Payer. The introductory matter includes a sketch of European intercourse (missionary and other) with the region, and a list of tribes.

Salvador. *B.R.S.G. Madrid* **46** (1904): 272-276. **Peña.**

El lago de Güija. Por J. Maía S. Peña.

South America. *Nouv. Archiv. Miss. Sci.* **12** (1904): 81-129. **Montfort and De la Grange.**

Rapport sur une Mission Scientifique en Amérique du Sud (Bolivie, République Argentine, Chili, Pérou). Par MM. G. de Créqui Montfort et E. Sénéchal de la Grange. *With Maps.*

Reference has already been made to the scientific work of this expedition (cf. vol. **23**, p. 525; **24**, p. 482).

West Indies. **Vezey.**

Tourist Guide to the West Indies. London: published by the Royal Mail Steam Packet Company. Compiled by C. E. Vezey. 1904. Size 7½ × 10, pp. 118. *Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—Dutch. **Dissel.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **21** (1904): 787-821.

Beschrijving van een tocht naar het landschap Bahaam. Door J. S. A. van Dissel.

New Zealand. *T. and P. New Zealand I.* **36** (1903): 225-333. **Cockayne.**

A Botanical Excursion during Midwinter to the Southern Islands of New Zealand. By L Cockayne, PH.D. *With Maps and Plates.*

Contains much interesting information on the life-conditions of the vegetation of the Aukland, Antipodes, Bounty islands, etc., with a sketch of the history of the flora.

New Zealand—Coalfields. *T. and P. New Zealand I.* **36** (1903): 405-418. **Park.**

On the Age and Relations of the New Zealand Coalfields. By Prof. J. Park. *With Sections.*

Queensland. **Meston.**

Queensland. Report by Mr. A. Meston on Expedition to the Bellenden-Ker Range. [Brisbane], 1904. Size 13½ × 8½, pp. 18.

See note in the *Journal* for November, 1904 (p. 592).

Western Australia. *B. Geolog. Surv. W. Australia*, No. 11 (1903): pp. 58. **Maitland.**

Notes on the Country between Edjudina and Yundamindera, North Coolgardie Goldfield. By A. G. Maitland. *With Maps and Sections.*

POLAR REGIONS.

Antarctic—Argentine Expedition. *B.I.G. Argentino* **22** (1904): 9-21. **Yalour.**

El Viaje de la "Uruguay." J. Yalour.

The same number contains various papers by members of the Swedish Antarctic Expedition and the Argentine relief party.

Antarctic—Belgian Expedition. **Lecointe.**

Expédition Antarctique Belge. Au Pays des Manchots. Récit du Voyage de la *Belgica*. Par G. Lecointe. Bruxels: O. Schepens & Cie., 1904. Size 10 × 6½, pp. 368. *Maps and Illustrations. Price* 6*s.*

Arctic. *Vierteljahrs. Naturforsch. Ges. Zürich* **49** (1904): 128-142. **Rikli.**

Versuch einer pflanzengeographischen Gliederung der arktischen Wald- und Baumgrenze. Von M. Rikli.

Polar Regions—Temperature. *Ann. G.* **13** (1904): 289-295. **Passerat.**

La température des pôles. Par C. Passerat. *With Diagrams.*

MATHEMATICAL GEOGRAPHY.

Cartography. ———

New York Public Library. List of Maps of the World illustrating the progress of

geographical knowledge from the earliest times to the end of the Seventeenth Century. New York, 1904. Size 7 × 4½, pp. 38.

Catalogue of a fine collection of maps (some original, some reproductions) exhibited by the New York Public Library on the occasion of the visit of the recent International Geographical Congress. The list (though of course far from exhaustive) is representative of the most important maps of the period. There are one or two inaccuracies, and the dates of some maps of doubtful date are put down without any indication of uncertainty. A few maps of America, Africa, etc., are included.

Chronology. **Hanauer.**

A Table of the Christian and the Mohammedan Eras, from July 15, A.D. 622, the date of the Hejira, to A.D. 1900. By the Rev. J. E. Hanauer. London: Palestine Exploration Fund, [1904]. Size 8½ × 5½, pp. 24. *Presented by the Palestine Exploration Fund.*

Geodesy. *Petermanns M.* **50** (1904): 224–225. **Hammer.**

Der Längenunterschied zwischen Potsdam und Greenwich und das europäische Längennetz. Von Prof. Dr. E. Hammer.

Geodesy. **Herz.**

Geodäsie. Eine Darstellung der Methoden für die Terrainaufnahme, Landesvermessung und Erdmessung. Mit einem Anhange: Anleitung zu astronomischen, geodätischen und Kartographischen Arbeiten auf Forschungsreisen. Von Dr. N. Herz. (Die Erdkunde. Herausgegeben von M. Klar, xxii. Teil.) Leipzig und Wien: F. Deuticke, 1905 [1904]. Size 10½ × 7, pp. x. and 418. *Illustrations. Price* 14*m.*

Levelling. *Riv. G. Italiana* 11 (1904): 369–384. **Loperfido.**

Le moderne teorie della livellazione geometrica di precisione. Per A. Loperfido.

Longitude Determination. *Science* **20** (1904): 466-471. **Smith.**

Determination of Longitude. By E. Smith.

Navigation—Great Circle Sailing. *Ann. Hydrographie* **32** (1904): 375–385. **Roth.**

Studie über die Schiffahrt im grössten Kreise. Von A. Roth.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography—North Pacific. *Science* **20** (1904): 436–437. **Dall.**

Currents of the North Pacific. By Dr. W. H. Dall.

A comment on a previous communication by Dr. Bishop.

Oceanography—North Sea. **Everdingen and Wind.**

Conseil Perm. Internat. Explor. Mer, Publ. Circonstance, No. 14 (1904): pp. 10.

Oberflächentemperaturmessungen in der Nordsee. Vorläufige Mitteilung von Dr. E. van Everdingen und Dr. C. H. Wind. *With Diagrams.*

Oceanography—Tides. **Mensing.**

Der Hochseepegel und die Erforschung der Ebbe und Flut auf hohem Meere. Von A. Mensing. (Sonder-Abdruck aus der "Zeitschrift für Instrumentenkunde," 1903, November.) Berlin: J. Springer. Size 11 × 8, pp. 10. *Illustrations.*

Seismology. **Davison.**

A Study of Recent Earthquakes. By C. Davison. London and Newcastle-on-Tyne: The Walter Scott Publishing Co., 1905. Size 7½ × 5, pp. xii. and 356. *Diagrams and Illustrations. Price* 6*s. Presented by the Publishers.*

Detailed descriptions of "a few of the more important earthquakes that have occurred during the last half-century." The book will be of much value as supplementing existing text-books.

Tides. *Ann. Hydrographie* **32** (1904): 449–451. ———

Zusammenstellung einheitlicher Bezeichnungen für die Vertikal-Ausmessungen der Gezeiten.

Volcanoes. *Naturw. Wochenscrift* 3 (1904): 929–935. **Lang.**

Die Gipfelkrönungen von Vulcankuppen. Von O. Lang. *With Illustrations.*

Volcanoes. **Reclus.**

Proposition de dresser une Carte authentique des Volcans. Par E. Reclus. (Extrait du No. 11 [1903] du *Bulletin de la Société belge d'Astronomie.*) Bruxelles: Société belge d'Astronomie. Size 9½ × 6½, pp. 6. *Presented by the Société belge d'Astronomie.*

Zoo-geography—Reptiles. *P.A. Nat. Sci. Philadelphia* **56** (1904): 464–474. **Brown.**
Post-Glacial Nearctic Centres of Dispersal for Reptiles. By A. E. Brown.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial Geography. **Eckert.**
Grundriss der Handelsgeographie, von Dr. M. Eckert. 2 vols. Leipzig: G. J. Göschen, 1905. Size 9 × 6, pp. (vol. i.) xii. and 230, (vol. ii.) xvi. and 518. *Price* (vol. i.) 3.80*m.*; (vol. ii.) 8*m.* *Presented by the Publisher.* [To be reviewed.]

Historical—Columbus. **Vignaud.**
La Maison d'Albe et les Archives Colombiennes. Avec un Appendice sur les manuscrits que possédait Fernand Colomb et un tableau généalogique. Par H. Vignaud. (Extrait du Journal de la Société des Américanistes de Paris, tome 1[er], No. 3.) Paris, 1904. Size 11½ × 8, pp. 18. *Presented by the Author.*

History of Geography. *B.R.S.G. Madrid* **46** (1904): 176–210. **Duro.**
La Geografia en España en los siglos xvi. y xviii. Por C. F. Duro.

History of Navigation. *Ann. Hydrographie* **32** (1904): 473–482. **Schulze.**
Pastor Mauritius Rachels Geistlich See-Kompass. Von Dr. F. Schulze.

Account of an old work intended for the use of sailors, which was written at Petersdorf in Fehmarn in 1662. It included spiritual and intellectual as well as nautical instruction.

GENERAL.

Descriptive Geography. **Ratzel.**
Ueber Naturschilderung. Von F. Ratzel. München und Berlin: R. Oldenbourg, 1904. Size 7½ × 4½, pp. viii. and 394. *Plates. Price 7s. 6d. net.*

A treatise on the elements of beauty and impressiveness in natural objects and scenery, and on the art of observation and description of the same. It is intended as an aid to teachers desirous of arousing an appreciation of natural beauties in their pupils.

Educational. **Becker.**
Methodik des geographischen Unterrichtes. Ein pädagogisch-didaktisches Handbuch für Lehramtskandidaten und Lehrer. Von Dr. A. Becker. (Die Erdkunde, Herausgegeben von M. Klar. III. Teil.) Leipzig und Wien: F. Deuticke, 1905 [1904]. Size 10½ × 7, pp. viii. and 72. *Price* 3*m.*

Geographical Classics. **Krümmel.**
Ausgewählte Stücke aus den Klassikern der Geographie für den Gebrauch an Hochschulen zusammengestellt von O. Krümmel. Dritte Reihe: aus Sir Charles Lyell, Eduard Suess, Ferdinand von Richthofen, A. Grisebach und J. G. Kohl. Kiel und Leipzig: Lipsius & Tischer, 1904. Size 9½ × 6½, pp. vi. and 208. *Illustrations. Price* 2.50*m.* *Presented by the Compiler.*

The selection in this third and last instalment has been carried out with equal judgment with that shown in the preceding (*Journal*, vol. 23, pp. 275, 806).

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Ægina Island. **Lampadarios.**
Topographical Map of the Island of Ægina. By Dr. Emm. N. Lampadarios. Scale 1 : 24,500 or 2·1 inches to a stat. mile. Athens, 1904. *Price* 5*s.*

A general map of the island, with ancient roads and sites in red. The lettering is in Greek.

Cyprus. **Bellamy.**
A Geological Map of Cyprus. Compiled by C. V. Bellamy, F.G.S. Scale 1 : 348,480 or 5·5 stat. miles to an inch. London: Edward Stanford, 1905. *Price* 6*s.* *Presented by the Publisher.*

The topographical basis of this map is Stanford's reduction of the trigonometrical survey of Cyprus, executed by Captain H. H. (now Lord) Kitchener, R.E., in 1882.

The geological data and the accompanying text are the result of observations extending over a period of five years, during which Mr. Bellamy was stationed in the island. The text gives a brief explanation of the characteristics of the various formations. The map is on too small a scale to give much detail, but the general geological features are clearly indicated by different colours, one or two of which might have been less dense with advantage.

England. **Hewlett and Kelsey.**

Lancashire and Cheshire. Scale 1 : 126,720 or 2 stat. miles to an inch. Reduced from the Ordnance Survey by E. G. W. Hewlett, M.A., and C. E. Kelsey, M.A. 2 sheets. London: Edward Stanford, 1904. *Price* 15*s. net. Presented by the Publisher.*

In many respects this is an excellent specimen of a school wall map on the tinted contour or "layer" system, and it is evident that care has been taken with its production. One good feature of the map is that only tints of one colour—burnt sienna—have been employed, instead of several different colours, as is often the case. Thus there is a gradual gradation and increase in intensity of the tint from the lowest levels to the highest, with no abrupt change from green to brown. The first two tints show the land from sea-level to 300 feet and from 300 feet to 600 feet, the next is between 600 feet and 1000 feet, and after that the tints are at intervals of 500 feet up to 2500 feet. To have kept the intervals equal, and at the same time to have brought out the leading features, would perhaps have been a difficult matter, and without increasing the number of contours and tints considerably, the results could not have been satisfactory, as so much of the land is below 1000 feet; but it might have been better if the lower lands had been shown at intervals that were some even multiples of the others—say 250 feet apart; as they are now, the 300 and 600 feet lines somewhat disturb the symmetry of the orographical tinting. Railways are shown by thin red lines, and the relative population of towns is indicated by symbols. The difference between the high and low water line around the coast is shown by different tints of blue. The heights of many points are shown by figures in feet. The map is not overcrowded with names, and is most suitable, as a specimen of this kind of map, for educational purposes.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1905.

1-inch:—

(Third edition) in outline, 19, 219, 220, 222, 237, 257, 298, 1*s. each* (engraved).
(Third edition) with hills in brown or black, 9, 12, 19, 298, 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Brecknockshire, 5 N.W. **Herefordshire,** 6 S.E., 7 S.E., 10 S.W., 11 N.E., 17 N.W., N.E., S.W., 18 S.W., 19 N.E., S.E., 20 N.E., S.W., 21 N.W., 24 N.W., N.E., S.E., 25 N.W., N.E., S.W., S.E., 26 S.W., S.E., 32 S.E., 41 S.W., 47 S.W., 52 S.E. **Leicestershire,** 20 N.W. **Lincolnshire,** 145 N.E., 146 N.W., 147 S.W., 151 N.W. **Radnorshire,** 9 N.E., 10 S.W., S.E., 16 S.E., 17 N.E., 22 N.W., 23 S.E., 25 S.W., 28 N.W., 29 N.W., N.E., S.W., 30 N.W., S.W., 33 S.W., 34 N.W. **Rutland,** 5 S.E., 6 N.W., N.E., S.E., 7 N.W., 9 N.W., N.E., 11 N.W., 13 N.W., N.E., S.E. **Somersetshire,** 49 S.E., 50 S.E., 57 S.E., 60 S.W., 61 N.E., 69 N.W., N.E., S.W., 70 S.W., 72 N.W., 78 N.E., 79 N.W. **Suffolk,** 77 S.E. **Warwickshire,** 16 N.W., 17 N.W. **Worcestershire** (12 N.E. and 13 N.W.), 12 S.E., 13 N.W. and 12 N.E., 16 N.W., 23 N.W. **Yorkshire** (First Revision of 1891 Survey), 285 S.W. 1*s. each.*

25-inch—County Maps:—

Brecknockshire, VII. 8, 12; VIII. 1, 5; X. 5, 13, 14, 15, 16; XI. 6, 10, 13; XIV. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14; XX. 2, 3, 5, 6, 7, 9, 10, 13, 14, 15; XXVI. 1, 8; XXXVIII. 13; XLIII. 1, 5, 6, 8 (9 and 13), 10, 11 (13 and 9). **Carmarthenshire,** XI. 9, 13; XIX. 5, 9; L. 1, 5, 9. **Devonshire,** XVIII. 4, 8, 11, 12, 15, 16; XIX. 1, 5, 9, 13; XXI. 13, 14, 15, 16; XXIV. 12; XXVIII. 6, 7, 8, 10, 11; XXIX. 9; XXX. 4, 8; XXXI. 2; XXXII. 5, 9; XXXIV. 14, 15, 16; XXXV. 7; XXXVI. 15; XLIV. 8, 12, 15; XLV. 1, 2, 4, 5, 6, 8, 10, 11, 12; XLVI. 1, 5, 13; XLVII. 3, 7, 12; LVI. 1, 2, 3, 4, 5, 7, 8, 9, 10, 12; LVII. 5, 13, 14, 15, 16; LVIII. 13, 15, 16; LIX. 1, 6, 11, 12, 16; LXIX. 2, 3, 4, 6, 7, 10, 11, 14; LXX. 1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16; LXXI. 1, 5, 9, 13; LXXII. 1, 5, 10, 14; LXXXI. 2, 3, 4, 6, 7, 8, 10, 11, 16; LXXXII. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; LXXXIII. 3, 12; XCIII. 3, 4, 7, 11; XCIV. 1, 2, 3, 4, 6, 9. **Glamorgan,** III. 11. **Lincolnshire,** CXIV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXV. 5, 15; CXXIV. 3, 7, 11, 15; CXXV. 1; CXXVI. 1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXXVII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. **Norfolk,** CII. 2,

3, 6, 9, 10, 11, 12, 14, 15, 16; CIII. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16; CIV. 5, 9, 13, 15; CVI. 6, 7, 8, 11; CVIII. 4; CIX. 2, 3. **Suffolk**, XI. 11, 12, 15, 16; XIII. 1, 2, 3, 5, 6, 9, 10, 13, 14, 15, 16; XIV. 10, 11, 13, 14, 16; XV. 13; XVII. 13; XX. 3, 4; XXI. 1, 2, 4; XXII. 1, 2, 3, 4; XXIII. 1, 2, 3, 4; XXIV. 2, 3. **Warwickshire**, XIV. 1, 5, 11, 12, 16; XXI. 1, 2, 5, 9, 10; XXII. 3, 4, 7, 8, 11; XXIII. 1, 2, 5, 6, 9; XXIV. 3, 4, 7, 8, 10, 11, 12, 13, 14; XXV. 2, 3, 7, 9; XXXI. 1; XLII. 4. **Worcestershire**, VI. 11, 12, 16; XVII. 13, 14; XXIV. 1; XXVII. 5; XXXV. 4; XXXIX. 8. *3s. each.*

England and Wales. **Geological Survey.**

1-inch map (New Series). Colour printed.

Reading, 268; Southampton, 315; Dorchester, 328; Weymouth, 342. Drift editions. *1s. 6d. each.*

(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographische Abtheilung der Königl. Preussische Landes-Aufnahme. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 240, Wittenberge; 264, Klötze; 289, Obisfelde. Berlin, 1904. *Price* 1.50*m. each sheet.*

ASIA.

China. **Chow and Sonne.**

Map showing the Telegraph Lines of China. By W. P. Chow and C. Chr. Sonne. Shanghai: Oriental Press, 1903.

A large roughly drawn outline map of a diagrammatic character, showing only the telegraph lines and cables. Names of places are in Chinese and English.

China. **Inspectorate-General of Customs and Post.**

Postal Working Map of China. Compiled in the Postal Secretary's Office, Inspectorate-General of Customs and Post, Peking, May 15, 1903. Shanghai: Oriental Press, 1903.

This map gives a considerable amount of information concerning the postal roads and postal districts of China. Postal towns are shown in black, and non-postal towns in brown. Telegraph stations are indicated, and other information is given. No hills are shown, and the map is only in outline. There are insets on enlarged scales of the Hankau, Canton, and Newchwang districts.

Negri Sembilan. ———

Map of the Negri Sembilan, Malay Peninsula. Scale 1 : 126,720 or 2 stat. miles to an inch. Compiled from Revenue Surveys. 2 sheets. Southampton: Ordnance Survey Office, 1903.

This is by far the best map that has been published of this imperfectly explored part of the Malay peninsula. It is printed in colours, and shows roads, paths, railways, telegraphs, and alienated lands—agricultural and mineral—besides giving general information as to the physical features of the country.

Persia. **Stahl.**

Routenkarte von Zentral und Nordwestlichen Persien nach eigenen Aufnahmen von A. F. Stahl. Scale 1 : 840,000 or 13·2 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafeln 1 u. 2. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Siberia. **Guérassimoff and Meister.**

Carte géologique de la région aurifère de la Léna. Dressée par A. Guérassimoff. Scale 1 : 42,000 or 1·5 inch to a stat. mile. Sheet P6. Carte géologique de la région aurifère d'Iénisséi. Dressée par A. Meister. Scale 1 : 84,000 or 1·3 stat. mile to an inch. Sheets: K 7 and 8; L 6, 8, and 9. St. Petersburg: Comité Géologique, 1902–3. *Presented by the Comité Géologique, St. Petersburg.*

These sheets are in continuation of the geological maps of the auriferous regions of Siberia which have been in course of publication for some years. They are on sufficiently large scales to show a considerable amount of detailed geological data, and, in addition to the maps themselves, there are useful sections across the regions in different directions.

AFRICA.

Africa. **Topographical Section, General Staff.**

Africa. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet 71, Monrovia.

Price 2*s. each sheet.* Scale 1 : 250,000 or 3·9 stat. miles to an inch. British Central Africa. (Provisional) Sheets: 105-G, Songwe river; 105-K, Nyika plateau. *Price* 1*s.* 6*d. each sheet.* Egyptian Sudan. Sheets: 66-M, Hillet Nuer; 78-A, Ghaba Shambe. *Price* 1*s.* 6*s. each sheet.* London: Topographical Section, General Staff, War Office, 1905. *Presented by the Director of Military Operations.*

Central Africa. **Grey.**

Tanganyika Concessions, Limited. Mr. George Grey's map showing exploration and discoveries up to August, 1904. Scale 1 : 1,013,760 or 16 stat. miles to an inch. London: Whitehead, Morris & Co., [1905]. *Presented by George Grey, Esq.*

The first edition of this map, which showed the results of explorations up to September 8, 1902, was noticed in the *Geographical Journal* for July, 1903. Since then a considerable amount of exploratory and survey work has been accomplished by the company's officers, the results of which are embodied on this new edition which has just appeared. This is specially the case in the western part of the map. Much of the work is necessarily of a preliminary nature, and consists only of route surveys. No attempt has been made to give the longitudes, which perhaps, in the present state of their uncertainty, is the best course to adopt.

Egypt. **Hughes.**

New Map of the Egyptian and Sudan Goldfields. Compiled by Geo. Hughes. Scale 1 : 1,393,920 or 22 stat. miles to an inch. London: The Charto Map and Plan Co., [1904]. *Price* £3 3*s.*

This map shows the limits of the various mining concessions and properties of different mining companies in Egypt and the Egyptian Sudan. It also shows the location of ancient mines and old workings, in addition to wells, caravan routes, and other general information. The information from which the map has been compiled has been chiefly obtained from mining engineers and other officers attached to exploring and prospecting expeditions despatched by the different companies whose properties are shown upon the map. The style in which the map is produced is extremely rough.

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheet F4, Gawiro. Berlin: Dietrich Reimer (Ernst Vohsen), 1904. *Presented by Herr Max Moisel.*

AMERICA.

Argentine Republic. **Greiner.**

Plano Catastral de la Gobernacion del Chubut. Por U. Greiner. Scale 1 : 750,000 or 11·8 stat. miles to an inch. 4 sheets. Buenos Aires: Libreria Alemana, 1904.

This map, which is printed in colours, has been compiled from the latest information, including the surveys of the Chile-Argentine Boundary Commissions. It is specially interesting as showing the location of the Welsh colonies. The map is well executed, and has been lithographed in Justus Perthes geographical establishment in Gotha.

Buenos Aires. **Ludwig.**

Nuevo Plano del Municipio de Buenos Aires y parte del Partido de Avellaneda. Publicado por Pablo Ludwig segun los datos mas recientes. Scale 1 : 35,000 or 1·8 inch to a stat. mile. Buenos Aires, 1904.

Panama Republic. **Military Information Division, U.S. Army.**

Map of the Republic of Panama. Scale 1 : 696,960 or 11 stat. miles to an inch. Prepared in the War Department Office of Chief of Staff, Second (Military Information) Division, General Staff, U.S. Army, January, 1904.

A somewhat roughly executed map, with soundings round the coast-line. In most parts of the interior little information is given, and the chief importance of the map is that it shows the line of the proposed canal.

GENERAL.

World. **Debes.**

Neuer Handatlas über alle Teile der Erde. Herausgegeben von E. Debes. Dritte verbesserte Auflage. Leipzig: H. Wagner & E. Debes, 1905.

This is the third edition of Debes' well-known general atlas. No new maps have been added, and the arrangement of the plates is similar to that in the earlier edition of the atlas. The excellent style in which it has been produced, and the reliable character of the information it gives, have obtained for the atlas a good reputation. In the preparation of this edition the maps have been carefully revised.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte Auflage. 20 Lieferung. Vienna and Leipzig: A. Hartleben, [1904]. *Price* 50 *pf. each part.*

This is the concluding part of the fourth edition of this cheap general atlas, and contains the index and following plates: 27, Germany, sheet iv.; 38, Galicia and Bukowina; 70, Syria, Palestine, and Cyprus.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November and December, 1904. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
2287		Tidal streams round the British isles. 1*s.*
2498 m	= 2·7	Scotland, west coast:—Southern part of the sound of Raasay and Inner sound. 2*s.* 6*d.*
3441 m	= 6·9	Scotland, west coast:—Gairloch. 2*s.* 6*d.*
3422 m	= 6·8	Scotland. Hebrides:—East loch, Roag. 3*s.* 6*d.*
3444 m	= 6·9	Ireland, south-west coast:—Crookhaven, Ballydivlin, and Toormore bays. 2*s.* 6*d.*
3467 m	= var.	Iceland, plans on the north coast:—Kalshamarsnes, Blondaos, Selvig, Hagenesvig, Sandvig, Husevig, Snerstastadir, Thorshavn. 1*s.* 6*d.*
3462 m	= 5·9	British Columbia:—Southgate group and anchorage. 1*s.* 6*d.*
3464 m	= var.	Alaska. Harbours and anchorages in. 1*s.* 6*d.*
3477 m	= 4·0	Africa, west coast:—Port Forcados. 1*s.* 6*d.*
628 m	= 3·0	Africa, west coast. Bight of Biafra:—Opobo river. 1*s.* 6*d.*
839 m	= 4·0	East Indies. Andaman islands:—Port Meadows and Kotára anchorage. 1*s.* 6*d.*
3471 m	= 0·4	Sumatra:—Banka strait. 2*s.* 6*d.*
3463 m	= 0·97	Philippine islands, Mindanao, south coast:—Dumankilas bay. 1*s.* 6*d.*
3449 m	= 6·0	China, east coast:—Amoy, outer harbour. 2*s.* 6*d.*
1260 m	$= \begin{Bmatrix} 0·98 \\ 9·4 \end{Bmatrix}$	China, north coast:—Ching tsu shan to Chifu bluff, including Chifu or Yentai harbour. Plan:—Chifu or Yentai landing. 2*s.* 6*d.*
3468 m	= var.	China, north-east coast. Plans on the coast of Shantung:—Malan and Lungyen coves. Yangyuchih bay. Litau bay. Ayleu bay. 1*s.* 6*d.*
3457 m	= 0·98	China, north coast:—Litau bay to Chutau, including Wei hai wei harbour. 2*s.* 6*d.*
3019 m	$= \begin{Bmatrix} 2·0 \\ 3·9 \end{Bmatrix}$	Japan. Kiusiu, north-west coast:—Imari wan and approaches. Plan:—Hibi Suido. 2*s.* 6*d.*
2441 m	= 0·32	Japan:—Tsugaru strait. 2*s.* 6*d.*
3455 m	$= \begin{Bmatrix} 1·98 \\ 4·00 \end{Bmatrix}$	Japan. Nipon, south coast:—Aikuchi bana to Yeboshi bana, including Nagashima wan and Kanzaki wan. Nishiki wan. 2*s.* 6*d.*
3460 m	$= \begin{Bmatrix} 1·9 \\ 4·0 \end{Bmatrix}$	Japan. Nipon, south coast:—Ino hana to Aikuchi bana, including Kada wan and Owashi wan. Kuki ura. 2*s.* 6*d.*
3458 m	= var.	New Guinea. Plans of anchorages on north-east coast:—Buna roads, Oro bay, Port Harvey, Anasari harbour, Pusi Pusi harbour, Wamnea anchorage, Kitava island anchorage. 1*s.* 6*d.*
3436 m	= 0·49	New Zealand, east coast:—Plate island to Cape Runaway. 2*s.* 6*d.*
1103 m	= var.	North Pacific ocean:—Palao or Pelew islands, Korror harbour, Helen reef, Mapia island, Los Martires. 1*s.* 6*d.*
3461 m	= 2·4	Pacific. Tubuai islands:—Vavitao or Ravaïvaï. 1*s.* 6*d.*
87		Spain and Portugal, west coasts. Plan added:—Sines bay.
1128		Mediterranean sea. Sardinia, ports in. Plan added:—Arbatax road.
2634		Mediterranean sea. Syria, Ras En-Nakura to El Arish. Plan added:—Yafa anchorage.

No.
369 Cape Verde islands. Plans added:—San Filippe and Encarnaçao anchorages, port St. Jago. New plans:—Porto Praya, English road (Mayo I.).
3004 Iceland. Places on the south and east coasts. Plan added:—Vestmannaeyjar.
652 Africa, east coast. Plan added:—Mozambique anchorage.
1809 Africa, east coast. Mozambique to Ras Pekawi. Plans added:—Port Duarte Pedroso, Belmore harbour, Port Nakala.
764 South-West Pacific. New Hanover, etc. Plan added:—Peter haven.
55 South-West Pacific. New Ireland, etc. New plan:—Nusa harbour.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
2498	Southern part of the sound of Raasay, etc.	Same title	2498
2184	Crookhaven. Plan on this sheet	New plan. Crookhaven, Ballydivlin, and Toormore	3444
252	Port Bona. Plan on this chart		
369	Mayo. Plan on this sheet		
628	Plans in the bight of Biafra:—Opobo river.	New plan. Opobo river	628
1809	Fernando Veloso bay. Plan on this chart.	New plan. Port Nakala	1809
2837B	Plan of Abu Shahr on this chart		
839	Port Meadows.	New plan. Port Meadows and Kotára anchorage	839
1260	Chifu or Yentai harbour.	New chart. Chingtsu shan to Chifu bluff, including Chifu or Yentai harbour	1260
1256	Chifu islands anchorage. Plan on this chart.		
3019	Tsu saki to Kagara-sima.	New plan. Imari wan and approaches	3019
2441	Tsugaru strait.	New chart. Tsugaru strait	2441
952	Nag ura. Plan on this chart.	New plans. Aikuchi bana to Yeboshi bana	3455
951	Kada bay. Plan on this chart.	New plan. Ino hana to Aikuchi bana, etc.	3460
356	Owasi bay. Plan on this chart.		
1103	Palau or Pelew islands	New sheet of plans	1103

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1167, England, west coast:—Burry inlet. 1543, England, east coast:—Yarmouth and Lowestoft roads, etc. 1625, England, east coast:—Seaham harbour. 2296, Baltic:—Gulf of Bothnia (Sheet 1). 2646, France, west coast:—Bourgneuf to Ile de Croix. 2989, France, west coast:—Entrance to the Loire river. 2664, France, west coast:—Pointe d'Arcachon to Pointe de la Coubre. 92, Spain, west coast:—Cape St. Vincent to Gibraltar. 1567, Africa, north coast:—Approaches to Bona. 308, North America:—Gulf and river of St. Lawrence (Plans in). 2818, United States, east coast:—Hampton roads. 969, South America:—Pernambuco roads. 551, South America, east coast:—Port San Antonio, Port St. Elena. 461, Africa, west coast:—Wari and Benin rivers and creeks. 622, Africa, west coast:—Bonny and New Calabar rivers. 1810, Africa, east coast:—River Zambesi to Mozambique harbour. 665, Africa, east coast:—Zanzibar harbour and its approaches. 1235, Persian gulf:—Mouth of the Euphrates. 1419, Bay of Bengal. Andaman islands:—Long island to Port Blair. 1348, Borneo:—Natuna islands. 1180, China, east coast:—Approaches to Hongkong. 2618, China sea, Formosa, north coast:—Ke lung harbour. 1798, China, north coast:—Kwang tung peninsula, etc. 1259, Korea:—Fusan harbour. 2875, Japan, Naikai (Seto uchi). 2924, Australia,

east coast:—Cape Grafton to Hope islands. 2923, Australia, east coast:—Hope islands to Turtle group. 939, New Guinea:—Cape Nelson to Hercules bay. (*J. D. Potter, Agent.*)

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Chart, No. 98. Tierra del Fuego. Parte occidental del Canal Beagle entre la Peninsula Brecknock i Tres Brazos. Scale 1 : 250,000 or 3·4 stat. miles to an inch. Valparaiso: Oficina Hidrografica, Marine de Chile, 1904. *Presented by the Directors of the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for February, 1905. London: Meteorological Office, 1905. *Price 6d. Presented by the Meteorological Office, London.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for February, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for February, 1905. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

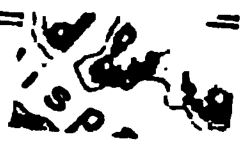
Persia. **Sykes.**

Fifty-four photographs of Eastern Persia, taken by H. R. Sykes, Esq., M.A. *Presented by H. R. Sykes, Esq., M.A.*

Mr. Sykes has already presented a large number of most interesting photographs of Persia to the Society, which were noticed in the November number of the *Geographical Journal.* In addition to these, he has now added the following:—

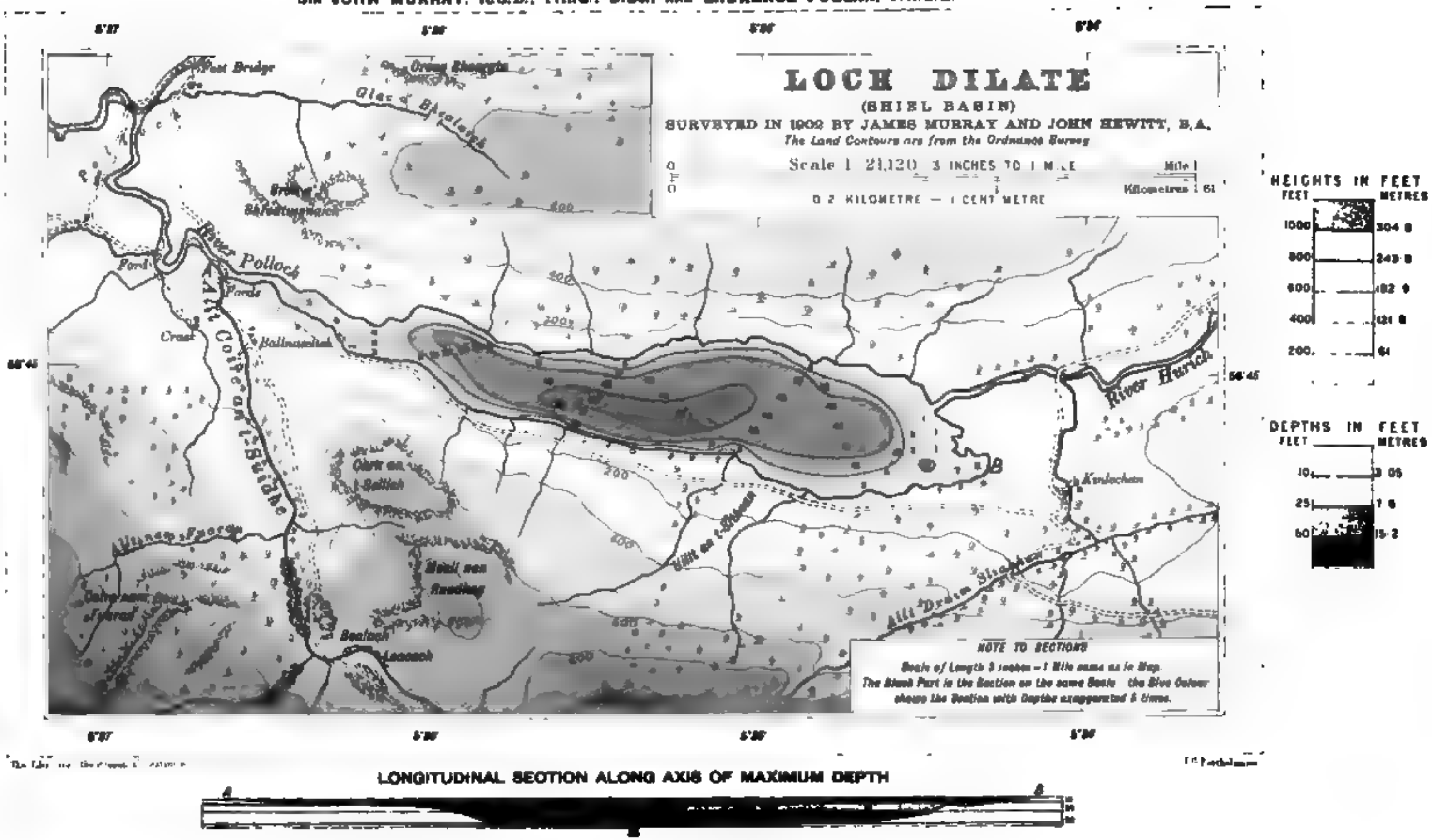
(1) Part of a row of fifty windmills at Neh; (2) The fort at Neh, looking east; (3) Women of Neh weaving cotton fabric; (4) Bundan, entrance to the village; (5) Baluch horseman at Bundan; (6) Natives of Bundan; (7) Sistan, village of Govdars; (8) Sistan, the British consulate; (9) Sistan, the British consulate under 5 inches of snow; (10) The Mil-i-Kasimabad, Sistan; (11) View within the ancient citadel of Zahidan; (12) Ziarat of the Chehel-Pir, Sistan; (13) Outside view of the north-west corner of the citadel, Zahidan; (14) Ruins at Zahidan; (15) View of the Darvazeh-i-Nadir, a fortified gap in the mountain range 10 miles west of Nasratabad; (16) Sistan, Kuh-i-Khwaja, looking west; (17) North-east gate of ruined city of Ghaghow; (18) Ancient tombs on Kuh-i-Khwaja; (19) Ziarat of the Pir-i-Gandum on Kuh-i-Khwaja; (20) The fort of Kuk, Kuh-i-Khwaja; (21) Ruined city of Ghaghow; (22) In the Lut, Turshab, looking south-west; (23) View of Varmal; (24) Sistan, group of Sayads; (25) Baluch family and habitation, Sistan; (26) Nasratabad, in the Lut interior; (27) Nasratabad, in the Lut exterior; (28–31) Scenes from the "Tazieh," or mourning play; (32) The Kala-i-Sang, an ancient fortified capital of the Kerman province; (33) A mutilated pulpit within the ruins at the Kala-i-Sang; (34) The pinnacle of the Kala-i-Sang; (35) Rock inscriptions in the Kala-i-Sang; (36) The Shah-neshin, or King's seat, near the summit of the Kala-i-Sang; (37) Rock carvings in the Shah-neshin; (38) View of the ruins looking north, Kala-i-Sang; (39) View of the ruins looking south, Kala-i-Sang; (40) The Kala-i-Sang, looking east; (41) Ancient fortification on a rock 20 miles south of Seyidabad; (42) In the Tang-i-Niza near Hajiabad; (43) Village and villagers, Hajiabad; (44) Caravan encampment near Hajiabad; (45) Dr. Summerhayes attending a native of Hajiabad recently wounded by Afshars; (46) Village of Gakan; (47) Entrance from the north side of the Tang-i-Zagh; (48–51) In the Tang-i-Zagh; (52) In the Tang-i-Zagh, emerging at the southern end; (53) Village of Zaratu; (54) The celebrated sulphur spring at Ginao.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



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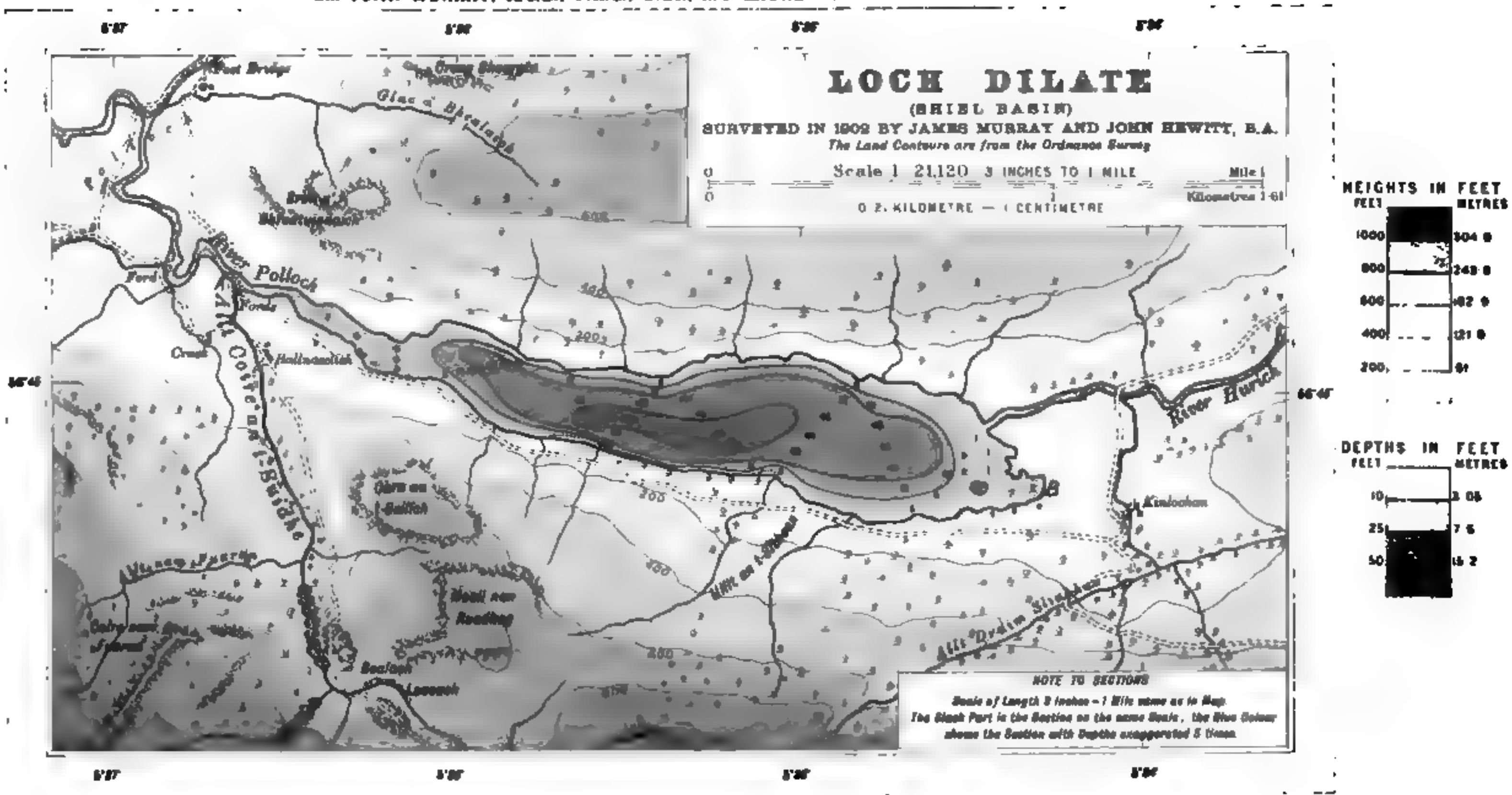

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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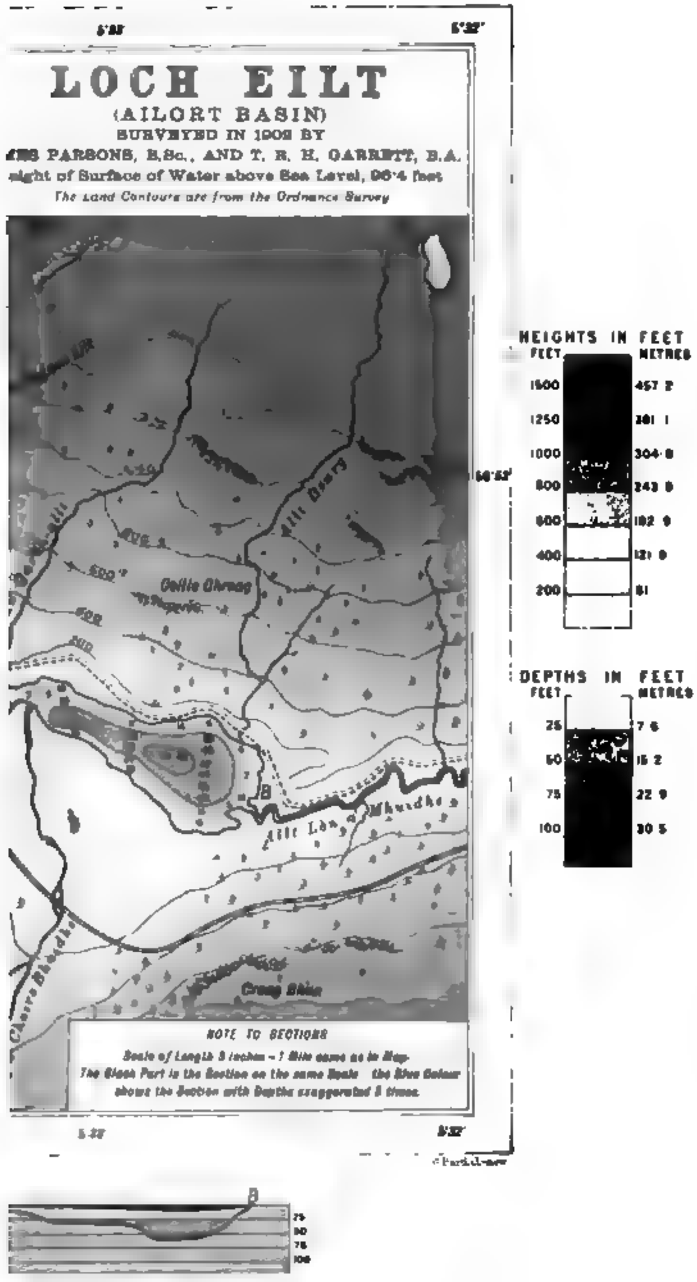
LOCH EILT
(AILORT BASIN)
SURVEYED IN 1902 BY
PARSONS, B.Sc., AND T. R. H. GARRETT, B.A.
Height of Surface of Water above Sea Level, 96·4 feet
The Land Contours are from the Ordnance Survey
Allt Dearg
Coille Ghrmag
Allt Lon a' Mhuidhe
Creag Bhàn
NOTE TO SECTIONS
HEIGHTS IN FEET
FEET
METRES
1500
457 2
1250
381 1
1000
304·8
800
243 8
600
182 9
400
121 9
200
61
DEPTHS IN FEET
FEET
METRES
25
7 6
50
15 2
75
22 9
100
30 5
B

The

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RESULTS OF THE NATIONAL ANTARCTIC EXPEDITION.— I. GEOGRAPHICAL.*

By Captain ROBERT F. SCOTT, C.V.O., R.N.

IN the following paper I propose to confine myself mainly to the purely geographical results of the Antarctic Expedition, in considering the distribution of land, water, and ice within the area allotted to us for exploration. I do so because a true estimate of these conditions will be arrived at, not so much by a close study of records as by a free discussion of observations and ideas, which, crude as they may be, can be advanced at once without prejudice. I avoid referring otherwise than in the most general terms to the results of the other scientific work carried out by our specialist investigators, partly because I realize my inability to cope with such a task in a satisfactory manner, partly because the main outline of much of the work has already been given by the officers concerned, but mainly because the time at my disposal is inadequate to do more than consider the subject which I have chosen. I believe that the matter which I propose to set before you is of general interest, and had I attempted further digressions, not only must it have been robbed of its interest, but too large a field would have been opened to the discussion which I hope may follow. I must assume, in all that I have to say, that the published reports of the history of the expedition are known.

Pack Ice.

The ice-conditions in the Ross sea have been observed in the course of five different summers. Although differences in date make it impossible to closely compare those seasons, one is led to believe that four

* Read at the Royal Geographical Society, February 27, 1905. The provisional map in vol. 24, p. 248, may be referred to; a finished map is in preparation, and it is hoped will be published in the *Journal* before the end of the year.

were very similar and constitute the normal condition, whilst one, the summer of 1902–3, was exceptional. The normal condition seems to be that the sea becomes completely frozen over in the winter, the movement of the ice-sheet leaving narrow spaces of open water only at its edge in such places as the northern face of the Great Barrier, and possibly in occasional rents, which are speedily refrozen. The emperor penguin undoubtedly takes advantage of the continual strip of open water that fringes the barrier.

The gales at Cape Crozier grow excessively violent towards the end of September and in October, and by this time the sun has taken some effect on the ice-sheet. The general break-up which results has been witnessed on two occasions by our sledge parties ; on one day they saw the sea completely covered with ice, and on the next looked forth on a clear sheet of open water. The ice thus freed drifts to the north, and forms that belt of pack through which ships must pass to reach the sea in the early summer. Drifting under the influence of wind, loose pieces of ice will always travel faster than the main pack, and consequently the southern edge of the band will generally be a hard and fast line, where loose pieces are crowding on the main pack, and the northern edge will be free, where loose pieces are tending to detach themselves from it.

Towards the end of December and the early part of January this belt extends from the Antarctic circle for about 200 miles to the south, and, as Captain Colbeck has said, is probably best attacked on the meridian of 178° to 180° E. To the westward of this the pack would be augmented by the coastal ice of Victoria Land, and to the eastward by conditions which are not well known, but on which the discovery of Scott island and the difficulties experienced by Ross seem to throw some light.

The ice probably leaves the Ross sea in large fields, and is broken by the ocean swell, which penetrates the pack for a very great distance ; and this accounts for the fact that the floes increase in size as one approaches the southern edge, nowhere exceeding 1 or 2 miles in length. In this connection it is interesting to note the large fields, 4 or 5 miles across, which Captain Colbeck saw north of the Balleny islands in 1900.

The character of the ice frequently changes, giving the impression that a quantity of ice of a previous season is caught when the sea freezes over; but none of the ice met with is formidable—all is more or less rotten and decayed.

The exceptional ice-conditions of the summer of 1902–3 seem to have arisen from causes commencing at a very early date in the winter of 1902. What must be considered an abnormal succession of southerly gales again and again broke up the ice in McMurdo sound, and even late in the winter there was open water within a few miles of the *Discovery*. The continual formation of fresh sheets of ice must have tended to congestion, which the exceptionally fine-weather conditions of December and January failed to relieve, so that the greater part

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COMMANDER OF THE NATIONAL ANTARCTIC EXPEDITION

of the Ross sea remained filled with ice, and not only had the *Morning* great difficulty in getting to the south, but the sea was never sufficiently open to admit of the swell, on which we depended to break up the fast ice in McMurdo sound and free the *Discovery*.

In connection with the latter fact, it is of interest to note that, though the main pack drifts to the north early, there is an eddy in McMurdo sound in which a mass of ice is detained throughout December and January. At the end of January in 1902 and 1904 this mass was suddenly carried to the north, but it did not disappear until nearly a month later in 1903. When this occurred there was a noticeable change in the drift of the surface waters through the strait.

Continuing to drift northward, the main pack is dissipated by the beginning of February, and during this month a ship, by coming directly south on the 178th meridian, could reach the Great Barrier without encountering any pack ice. The sea-ice met with on the coast of Victoria Land is of a quite different character from that found in the main pack. It is very hard, very solid, comparatively free from snow, and, except where dust and grit have settled on the surface, very little decayed. Its uniform smoothness shows that there is very little pressure. In the bays and inlets we noticed that the floes had a great regularity of outline, and especially in Granite harbour we found that the ice-sheet had broken into almost perfect rectangular rectilinear figures. In all the coast ice there were large quantities of diatoms, which gave a yellowish-brown appearance to the underside of the floes. The pack ice met with in the vicinity of King Edward's Land was very heavy, but differed in character. Some floes were much hummocked, and were evidently more than one season old, whilst others were of comparatively recent growth. It appears probable that a large quantity of pack is detained amongst the numerous grounded bergs and ice islands in this region, where also the snowfall seems heavier than to the west.

The region south of the Balleny islands will probably always be found heavily packed. Our course from Robertson bay to the north, and then to the west past Sturge island, practically gives the eastern limits of this pack at the end of February, 1904, although Ross found, at the same season in 1841, that it did not lay beyond the 168th meridian.

Icebergs.

The main supply of icebergs in the Ross sea is from the Barrier and the eastern land. The glaciers on the coast-line of Victoria Land are in an extraordinary condition of stagnation, and nearly all the bergs met with along the coast have undoubtedly come from the east. From Cape Adare to Cape Crozier there are only two ice-flows capable of giving off a clean tabular berg of any dimensions. The rate at which various regions give off bergs can be to some extent gauged by the comparative newness of the exposed faces of the ice-cliffs.

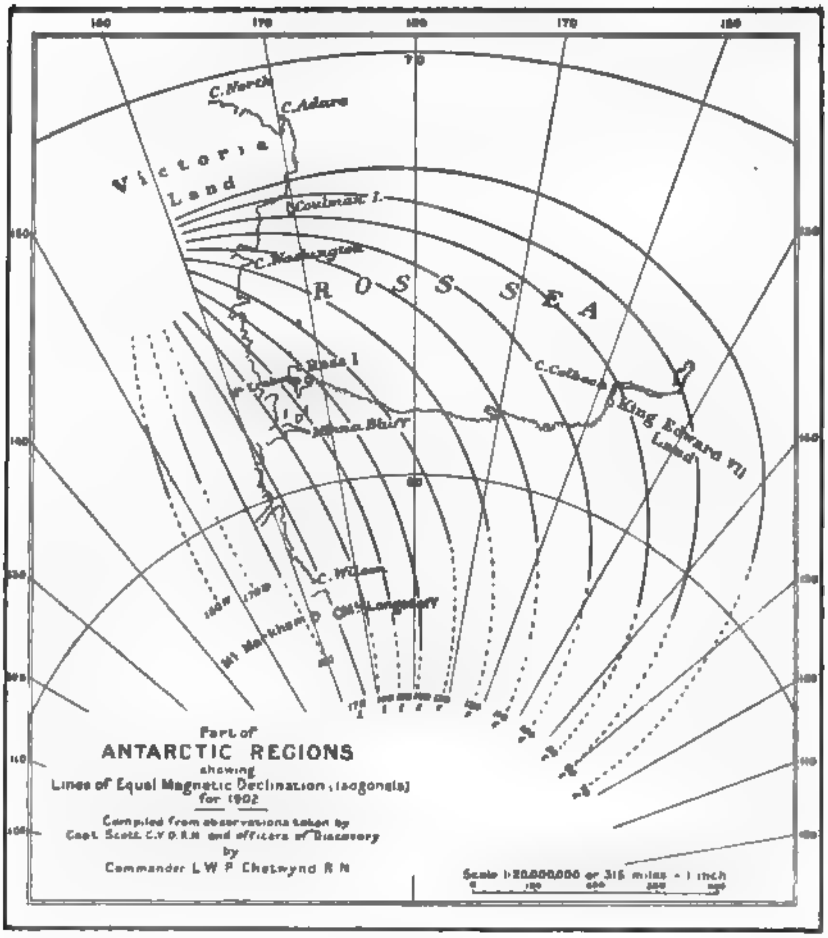
Innumerable bergs are aground on the shoals off the eastern land, and some are very large. We saw one or two small ones in the act of calving from the high cliffs in that direction, but we did not see any being detached from the Great Barrier, and gathered from an examination of the edge that it must break away in very large pieces.

A stream of small bergs, with an occasional large one, sets along the barrier and turns north along the western land. They are delayed in the larger bays and inlets, and hung up on such shoal patches as exist off Cape Crozier, Cape Washington, and Cape Adare. From the latter especially there extends a long string of grounded bergs, where they have appeared to attempt to turn the corner too sharply in an effort to follow the coast. To the westward of Cape Adare, stretching toward Cape North, we saw immense quantities of bergs; but after turning to the north we saw none until we had passed to the westward of the Balleny islands, when they were fairly numerous. I cannot think that the bergs we saw before entering the pack in January, 1902, can have any connection with the Ross sea, but they probably originate to the eastward, and it is interesting to note those seen by Captain Colbeck to the eastward of Scott island.

The size of Antarctic icebergs has been the subject of some discussion, and there is much excuse for exaggeration. Of the many hundreds seen by us very few exceeded a mile in length or 150 feet in height; the vast majority were less than a quarter of a mile across and less than 120 feet high. The largest iceberg we saw was off King Edward's Land, apparently aground. We estimated it as about 5 or 6 miles in length, and it seemed to run back for an equal distance. In this region we also saw some very high bergs, and one is logged as 240 feet.

The proportion of the submerged to the visible part of an Antarctic iceberg was estimated by Sir John Murray as about 7 to 1. I am inclined to think that it is much less, but I have no exact measurements to adduce. My opinion is founded, firstly, on general observation of the depths in which bergs ground (120 to 150 feet bergs do not seem to touch bottom in more than 100 to 120 fathoms); secondly, on an eye estimate of the proportion as indicated in an overturned berg; and, thirdly, on the nature of the ice itself as exposed in the face of the berg or of the cliff from which it has come, the transition from snow to ice is very gradual, and strongly impresses one that the mass throughout must contain large quantities of air. For the above reasons, I am inclined to place the proportion as not greater than 5 to 1. Mr. Ferrar has some data concerning the aëration of ice taken from different parts of a berg, which might help to give an approximation. This factor appears to me of great importance, not only in calculating the mass of bergs, but as giving an indication of the thickness of the ice-sheet covering many parts of the Antarctic lands.

OFFICERS AND CREW OF THE "DISCOVERY."


C. North
C. Adare
Victoria Land
Coulman I.
C. Washington
ROSS SEA
Ross I.
C. Colbeck
King Edward VII Land
C. Wilson
Mt Markham
Part of
ANTARCTIC REGIONS
showing
Lines of Equal Magnetic Declination, (Isogonals)
for 1902
Compiled from observations taken by
Capt. Scott C.V.O. R.N. and officers of Discovery
by
Commander L W P Chetwynd R N
Scale 1:20,000,000 or 315 miles = 1 inch

Current.

The general drift of the current in the Ross sea is indicated by the direction taken by the bergs. We had the good fortune to recognize a berg on our return along the barrier which we had seen on the outward journey. It had drifted 70 miles to the west in twelve days; but the surface water had been moving at a greater speed, as we could tell by its effect on the ship. The tidal streams do little more than accelerate or retard this current, and it was only occasionally that we were helped in our journey to the south and east by a favouring stream. To the eastward of the Balleny islands the surface water is moving towards the north, but the absence of bergs seems to show that there is no deeper stream in this direction. To the westward of the Balleny islands we did not notice any marked current, and the bergs were much scattered.

The Inland Ice.

The main geographical interest of the *Discovery* expedition must lie in the practical observation of a coast-line from Mount Melbourne, in lat. 74½°, to Mount Longstaff, in lat. 83°, and of the conditions which lie to the east and west of this line. Our previous knowledge extended only to that part which lies between Mount Melbourne and McMurdo sound, and of this we had but the vaguest description.

The outline of the coast and the positions and heights of the mountain ranges are shown on the chart. It will be seen that the coastal mountains are comparatively low between Mount Melbourne and the Ferrar glacier, and it was the tabular structure of these that first indicated to us the horizontal stratification of the mainland. But low as the mountains are, in one place only does the internal ice-sheet seem to pour any volume of ice into the sea, whilst the mountains themselves form an effective screen to the conditions which exist behind them. I have one note only that throws light on these. Looking back over the ice-river in lat. 75°, one saw its surface rise sharply to a ridge between the coastal mountains, and I wrote, "Beyond this the surface still seemed to rise, and bare patches of rock could be seen at a greater altitude, but it was impossible to estimate the exact distance or height of these." As we journeyed inland and upwards on the Ferrar glacier the mountains on our right gradually rose in altitude, and when we reached the interior plateau, at a height of 9000 feet, we observed nunataks to the northward standing above our own level. From these observations, I think there can be little doubt that the land rises beyond the coastal mountains of the whole Prince Albert range, and that the interior ice-cap nearly maintains the altitude which it has to the southward. To the south of the Ferrar glacier there are a number of detached mountain ranges of great altitude that flank the coast. In the distance at which we first saw them they bore all the appearance of islands, but

closer approach not only narrowed the glaciers which lay between them, but showed us further mountains which lay beyond them, and revealed an extensive mountain region, beyond which must lie an ice-cap of great altitude and extent.

It is known that we travelled to the westward over a plain which did not vary in altitude more than 60 or 70 feet for 200 miles, but it will be remembered that one's view on such a plain is very limited, and it would be impossible to state definitely that the conditions are the same for many miles north or south of the line taken. The mild undulations of the plain were sufficient to make a slightly wavy horizon, which could be detected by swinging the levelled telescope of the theodolite, and I am inclined to think that on an average the northern horizon was slightly lower than the southern, but this was not a definite observation.

We did not reach the inland plateau of 8900 feet until we were fully 60 miles from the coast, and it is, therefore, extremely improbable that the full height of the ice-cap of Victoria Land could be seen anywhere from the sea or from the barrier surface. It is certain that the ice-cap is of very great extent, and the evidences which I have briefly sketched serve to increase the impression of its vastness, and to indicate that it maintains a great and approximately uniform level over the whole continent.

Whether we accept what our imagination must suggest, or whether we pause at the actual facts which have been discovered, this great ice-sheet is still unique. The reason for its unexpectedly level surface, the possible maximum thickness, and many other details concerning it, would seem to me to offer a fruitful field for discussion, and on such points I for one should be most grateful for the opinion of experts.

Glaciers.

There are innumerable glaciers on the coast of Victoria Land, but the great majority merely discharge local *névé* fields lying in the valleys of the coastal ranges. Very few run back to the inland ice, and these may be divided into two classes—the living and the dead. In the long stretch of coast between Cape Adare and Mount Longstaff, over 11° of latitude, there appears to be only four living ice-discharges from the inland. The first falls into Lady Newnes bay, the second is the ice-river in 75° S., to which I have already referred, whilst the Barne and Shackleton inlets form channels for the other two. The Skelton and Murdock inlets may actively discharge from the inland ice, but this is doubtful. From observations to which I have referred, there can be little doubt that the movement of the more northerly of these discharges is very slow, but judging by the movement of the barrier, the southern ones are more active.

The Ferrar glacier is typical of the dead glaciers; the ice lies in the valley practically stationary, and gradually wasting away from the

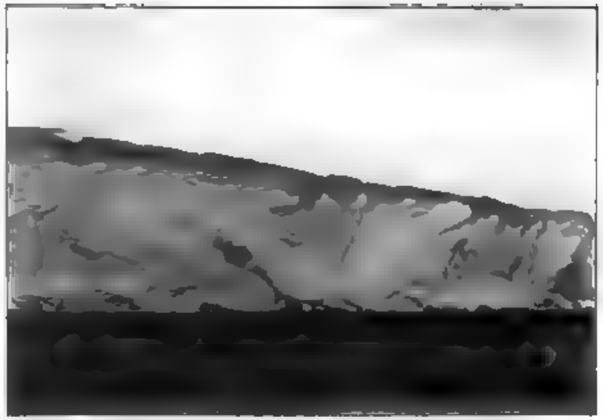
summer thawing. It is to all intents and purposes a dead limb. From lack of time for its construction, the inset chart does not very clearly show the ramifications of this glacier. Several discharges from the inland enter a common basin, from which two arms run towards the sea. Time does not permit me to touch on many interesting points concerning these details, but I may be permitted to refer to an exploration which I made of the "north" arm on my return from the west. Various observations on our outward journey, and whilst our ideas were yet unformed, had led me to suppose that there must be a considerable discharge of ice down this arm, and on my return I determined to explore it. After a day's journey down the glacier the ice became very rough, and we were obliged to leave our sledges and proceed with care. As we continued to descend, the glacier gradually dwindled, and then suddenly ended in the tamest manner in a wall of no great height. In the valley beyond we found some frozen lakes, and yet further in the narrow deep gorges, long lines and confused heaps of morainic *débris*. We walked on, hoping to gain sight of the sea, but were unable to do so. Perhaps in this valley, more than anywhere, lay the evidences of what was happening and what had been.

There lay the glacier inert and dead, whilst the summer sun slowly wasted its huge mass; on either side its shrinking tributaries had already severed their connection and receded up the steep mountain sides; one could no longer doubt a receding glaciation. Not only at our feet lay the morainic heaps to show what the glacier had once been, but thousands of feet up the hillsides they ran, till a clear-cut line showed the extreme limit to which it had once extended.

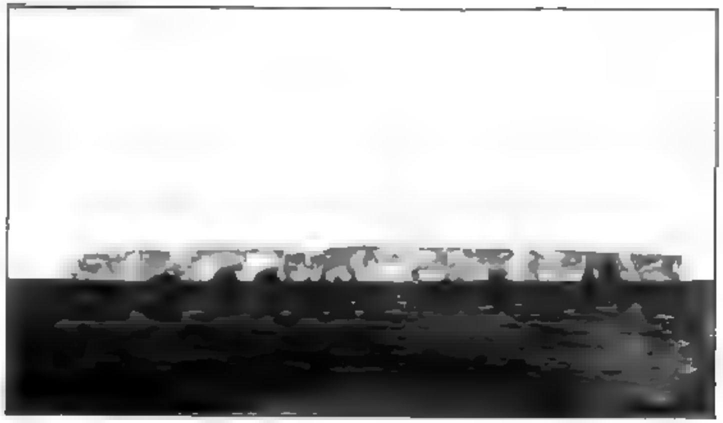
Here also I saw long morainic heaps 60 or 70 feet in height in the floor of the valley clean cut through by old watercourses, which now contain only the most modest streams; many of the boulders, well clear of the present streams, were quite smooth and rounded, whilst others at a greater height were sub-angular. This water-action must have been quite recent, *i.e.* since the glacier receded.

Mr. Ferrar has, I believe, measured the ancient high-tide mark of his glacier to be between 3000 and 4000 feet above its present level in places, but, of course, found the difference was less in the higher reaches.

The Ferrar glacier probably contains as much ice as any hitherto known in the world; the Barne and Shackleton glaciers contain a great deal more, and since they are now in such a diminished state, it is interesting to think what vast streams of ice they must have been at their maximum. To what extent the inland ice sheet stood above its present level is also interesting to surmise; one would submit a possibility of 400 or 500 feet.



THE GREAT ICE-BARRIER.



TYPICAL ANTARCTIC ICEBERG

THE WESTERN GLACIER.

The Great Barrier.

It is already known that I believe the greater portion of this great ice-sheet to be afloat. I will endeavour to give my reasons for this belief.

In considering the northern edge on the chart, if the figures showing the height in feet be taken as giving the depth in fathoms, a proportion of 6 to 1 for the submerged part will be allowed, and this I have already given reason for showing is an ample allowance. Since the soundings are given in fathoms, it will be seen that some hundreds of fathoms of water still intervene between the bottom of the ice at the barrier edge and the floor of the sea; but the barrier edge sixty years ago was in advance of its present position, in places as much as 20 or 30 miles, and therefore our soundings lie directly beneath Sir James Ross's barrier, and a considerable distance from its edge. The part that has broken away must therefore have been water-borne, and this, at least, shows the possibility of the remainder of the ice-sheet being afloat for an almost indefinite distance to the south. Had there been any doubt about the flotation of the barrier edge, it must have been dispelled by the fact that during our stay in the eastern inlet, although we had evidence of considerable tidal movement, the ice rose and fell with the ship.

Our long journey to the south was made practically over a level plain. Of this the gradual disappearance and reappearance of land masses over a continually level horizon could leave little doubt, but a yet clearer indication was the uniformity of the barometric pressures. The aneroid readings were recorded three or four times a day, and were frequently checked with the hypsometer. On returning from the southern journey, I tabulated the readings on each half degree of latitude, in comparison with simultaneous readings taken in the ship, applying the necessary corrections. When an empirical correction for a height of 200 feet is applied to the barrier readings, the comparative differences are extremely small, and if anything, the barrier readings are the greater, showing a fall in level, or what is, of course, a more probable explanation, a rise in the barometric gradient. It is fair to remark, however, that this comparison of pressures cannot be an exact method of determining levels under such circumstances. A small difference of pressure may be due to the normal barometric gradient, to local disturbance, or to instrumental error, as well as to a small difference of level. The point I wish to make is that a difference of level of 400 or 500 feet would introduce a discrepancy which could not be overlooked, and no such discrepancy occurs in our observations.

Incidentally, I might remark that the barometric observations made on our sledge journeys are noted in the meteorological record, and it would be of advantage if those taken to the south and west could be

extracted and tabulated, with a view to discovering differences of level. In the somewhat cursory examinations to which I have referred, I omitted to mention that there was an indication of a rise of level at the end of our journey; at this time we were close to the land, in the entrance to Shackleton inlet, where such a rise might well be expected.

As the great ice-sheet moves along the coast of Victoria Land, the thrust of the immense glaciers in the Shackleton and Barne inlets tends to push it from the land, and vast chasms are left between the ice-sheet and the land, partly filled with blocks of *névé* falling from the snow-capped foothills. For many miles from the entrances to these inlets the ice is waved into long curved undulations, and as one approaches them, the waves become more marked, the confusion increases, and cracks and crevasses grow numerous. Within 10 miles of the coast-line at any place there are signs of disturbance, and it can be easily understood that such a region is ill adapted for the sledge traveller.

But without the region of these disturbances, or some 10 to 15 miles from the land, the barrier moves with tranquillity, no ridge or crevass or other irregularity is met with, and the surface presents one monotonous even plain of snow. I submit that, if possible, it is improbable that a mass of ice could be pushing over the land in such an even, undisturbed fashion.

Where the ice-sheet is pushing past the Minna bluff and around the north and south ends of the White island, it is starred into long radial crevasses, running from 10 to 20 miles out from the land. The rifts are so straight, and close so gradually, that on crossing them the sides appear to have been mathematically ruled straight parallel lines. It is scarcely imaginable that such extraordinary uniformity of fracture should occur in an ice-sheet that was resting on the land, where there must be some irregularity in friction and ice-tension tending to divert the straightness of the rents.

In one of these crevasses extending from the north end of White island, Mr. Royds took some serial temperatures. Close to the land he found that the temperature fell with the depth to a mean level of $-9°$, but at a distance of 10 miles from the land he got a different result. Here at first the temperature fell, but deeper it gradually rose again, until at a depth of 19 fathoms the thermometer showed 0°. Deeper than this he could not go, on account of the snow in the crevass. But I think it must be conceded that the only reasonable cause for such a rise of temperature as was observed is the presence of water beneath the ice.

After our observation of the stagnant condition of the ice about our winter quarters and in the Ferrar glacier, the report of the barrier movement came as a surprise. Its discovery was more or less accidental. In September, 1902, I established Depôt A on the exact alignment of a sharp volcanic peak on the extreme end of the Minna bluff with the summit of Mount Discovery, the line running about west-

north-west and east-south-east. On visiting this spot in 1903, Mr. Barne found that the alignment was no longer "on," and thirteen and a half months after the establishment of the depôt he carefully measured its displacement from the original line, and found it to be 608 yards. The direction of its movement must be a little to the east of north, and consequently this figure probably represents the whole movement during the period.

The direction of movement of the ice-sheet is indicated by the vast ridges encountered off the eastern slopes of Mount Terror; here the sheet is pressing up and shearing past the land-ice, raising numerous parallel pressure ridges. It would almost seem possible that the movement was taking place along the inner or outer of these ridges according to the state of the tide. Dr. Wilson, who had the greatest opportunity of examining this region, thinks that there must be a submarine land ridge between Mount Terror and White island, checking the flow of ice in that direction. He also observed that glaciers on the south side of Erebus and Terror, where there is an exceptionally heavy snowfall, are pressing towards the south-west, eventually finding relief around Cape Armitage. That there was some pressure from the barrier around White island was shown by the pressure ridges which were formed on the eastern side of our peninsula. There are many points of interest in the junction of the barrier and the land, wherever it may be, and Mr. Barne has written an interesting account of the ice-disturbances which he saw on his southern journey, which, however, is too long for reproduction here.

I am inclined to place the eastern limit of the floating portion of the barrier near the inlet which we entered in long. 163° W. It is noticeable that the ice-cliff immediately to the east of this has not broken away since Sir James Ross traced it. Mr. Ferrar thought he actually saw a crack about which there was a differential movement of the ice, or, in other words, a tide crack. I reported the barrier surface to the south of this inlet to be undulating; it would perhaps be more correct to describe it as a plain intersected by valleys running east and west, and descending almost to the sea-level; the valleys do not occur at regular intervals, nor are their slopes regular. This disturbed condition of the normally level plain is, without doubt, due to King Edward's Land, but it is not easy to see why the effect should be precisely what it is.

The full extent of this great sheet of ice must, for the present, be merely a matter of surmise. At our most southerly point we saw long snow-capes running out beyond Mount Longstaff and meeting the level horizon; and farther still the mirage threw up small patches of white, indicative of still more distant capes and mountains. The scene to the south was much what it was to the north, and the weather was so bright and clear that we can make at least one statement with certainty. The high mountainous coast-line does not turn to the east, north of the

84th parallel, beyond the slight trend it already has in that direction.* But at such distances one can only speak of the high land. Whether the level surface of the barrier continues to skirt the coast-line for that distance, it is impossible to say, but, for my part, I am strongly inclined to think that it does.

Distribution of Land.

If the high coast-line be carried for 100 miles beyond our position in the direction in which we saw it, it will be seen to be making directly towards Graham Land, and I cannot but think that it continues to do so. If so, the geographical pole would be situated 200 miles or more from it and on the high ice plateau, which must continue behind if we allow for the comparatively rapid movement of the barrier.

The alternative theory held by many is that the coast sweeps round somewhere and joins King Edward's Land; if so, the turn, as I have pointed out, must be made a very long way south. Unfortunately, our knowledge of King Edward's Land is cursory. Judged by the outline of the hills and the blackness of the rocks, it appeared to be of the same comparatively recent volcanic formation as the land in the immediate vicinity of our winter quarters, but pieces of granite were brought up with the lead from the shallow water in its vicinity. In the region of Cape Colbeck the land is covered with a high-domed snow-cap, but to the eastward we had a long clear view of numerous peaks. Beyond those which fronted the coast-line were others at a greater distance, which gave a depth to the view. But we saw nothing like the wild rugged mountain scenery of Victoria Land.

Speculation on Former Conditions.

It is obvious that when the southern glaciation was at a maximum, when the glacier valleys were filled to overflowing, and when through all of them the great reservoir of inland ice was pouring vast masses into the Ross sea, the Great Barrier was a very different formation from what it is at present, and, as Mr. Ferrar has pointed out, there are abundant evidences of its great enlargement. Granite boulders are found on Cape Royds and high on the slopes of Terror, erratics, which can only have come from the mainland. On the slopes of Terror Dr. Wilson found morainic terraces 800 feet above the present barrier surface. Mr. Ferrar has shown that nearly the whole of the Cape Armitage peninsula was at one time submerged in the ice mass, and, in fact, on all sides of us, and everywhere, were signs of the vastly greater ancient extent of the ice-sheet.

It is not until one has grasped the extent of the former glaciation

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* As showing how far objects may be seen in the clear atmosphere of the Antarctic, at one and the same time we saw Coulman island and Mount Erebus, although separated by 4° of latitude.

SOUTHERN EDGE OF PACK-ICE AND OPEN ROSS SEA, LOOKING SOUTHWARDS

OVERTURNED ICEBERG.

and the comparatively rapid recession of the present that one can hope to explain the many extraordinary ice-formations that now remain in the Ross sea. I advance such an explanation with all deference to the distinguished audience which I address. I do not doubt that there will be disagreement with my conclusions, but if it leads to discussion, we may all benefit.

I am of opinion that at or near the time of maximum glaciation the huge glaciers, no longer able to float in a sea of 400 fathoms or more, joined hands and spread out over the whole Ross sea, completely filling it with an immense sheet of ice. At that time the edge of the sheet, and the first place at which the ice could become water-borne, bordered on the ocean depths to the north of Cape Adare. Then followed the receding ice-conditions, and at length a time when the ice-sheet was very curiously circumstanced. The Ross sea is very uniform in depth, north and south; the ice-sheet that pressed out over this level bottom would consequently be more or less uniform in thickness, and finally, the wastage would be more or less uniform over the whole area. As a natural consequence of such conditions there came a time when the whole ice-sheet became buoyant, and either it had to break away with great rapidity or to float whilst remaining fast. It floated and broke away gradually, and the present rapidly diminishing barrier is all that remains of the great ice-sheet; or rather, it is not all that remains, because I think that the whole coast bears signs and remains of the old barrier in curious ice-formations which can be accounted for in no other way. Lady Newnes bay is filled with a fragment of the barrier; the present ice discharges are wholly insufficient to account for such a sheet; moreover, its surface is not gradually inclined, but advances in long and steep undulations, the outer waves cut off by deep hollows from the interior mass. A single deep sounding in an inlet showed that here, too, the greater part of the ice-mass is probably afloat, and that it is held in by its exceptional land surroundings.

A still more curious fragment is the long tongue of ice, extending from the land in lat. 75°. Not only is its plan outline against the supposition that it can be fed by the ice-sheet, but at the outer end it is considerably higher than at the inner. Off the outer end we got soundings of 400 fathoms, which increases the difficulty of accounting for the continuance of such an unsupported mass of ice in its present position. But in this respect the same difficulty was emphasized in connection with a more wasted ice-tongue of the same description which jutted out from the slopes of Erebus within 8 miles of our winter quarters. This was a very long lathe-like tongue with serrated edges, and afforded us many arguments. I was with Captain Colbeck when he sounded off the end and at various spots on either side; nowhere could we get anything but very deep water. But the problem of how these

tongues remain at anchor has no bearing on their origin, and is, therefore, somewhat of a digression.

I would take, as another typical remnant of the greater ice-extension, one of the numerous steep snow-slopes that fringed the sea about our winter quarters. They start on a steep bare hillside, and, wedge-shaped in section, gradually increase in thickness till they end in a perpendicular cliff dipping into the sea. This feature in a modified form is reproduced along the whole coast-line as far south as the northern end of the White island. Yet one other formation deserves mention, namely, that which, for want of a better term, I may call the fan-shaped glaciers which lie under such steep cliffs as those of Coulman island. These are to some extent fed by the ice-cap above, but their size is out of proportion to such a supply, and they end in steep high cliffs often more than 100 feet above the sea. These too, I think, must be regarded as the last clinging remains of the old barrier.

I have probably wasted too much of your time in attempting to elucidate these ice problems, but I feel that the subject is one of great interest and worthy of discussion. I do not know that I have advanced anything startlingly new, but what I wish to generally impress is, that the majority of curious and often vast ice-formations met with in the Ross sea must be regarded, not as the result of present-day conditions, but as the rapidly wasting remnants of a former age.

Climate.

It has been a surprise to me to find that the idea that a great glacial epoch is the result of a comparatively mild climate is supported by much authority. Both Mr. Ferrar and I arrived at this conclusion independently when in the Antarctic. The chief argument is, of course, that it is physically impossible for cold air to contain much moisture, but, living in a severe climate, it was impossible not to realize that greater severity would have meant more sterile ice-conditions. In this connection it is interesting to note that our greatest snowfall occurred in the summer, and that the Balleny islands are more actively glaciated than Victoria Land. We observed two large avalanches of *névé* as we passed Sturge island. There can be little doubt that at the period of heavy glaciation the climate of Victoria Land was far milder than it is at present.

I should like to contribute some facts which may be of interest to meteorologists. Mr. Shaw has congratulated us on the possession of such an excellent beacon as Mount Erebus, from which we could gather the direction of the upper air currents. In this connection there were some interesting evidences to be gathered from the surface of the snow on the high level plateau of Victoria Land. The high hard winter sastrugi uniformly point between west by south and west-south-west; when we arrived on the summit, the wind was a little

THE GREAT CHASM.

MOUNT EREBUS WITH SMOKE.

south of west-south-west, and fresh light sastrugi had formed in that direction. During our stay the wind crept gradually round to south-west, and once or twice it went further south, with a rise of temperature and light snowfall. I gathered, firstly, that throughout the winter the wind blows from west-by-south, but during the summer creeps more to the southward; and, secondly, that there is no snowfall except in the summer, and on the rare occasions when the wind blows almost due south.

Erebus smoke blew almost persistently to the east, but we could not always exactly gauge its direction. It is curious to find that every sketch made by the Ross Expedition shows it going to the west, and Sir Joseph Hooker can remember it going in no other direction.

I understand that Mr. Shaw is of opinion that the south-east winds recorded in our winter station are not merely local. I should be glad to think it was so, but the weather conditions about the *Discovery* seemed to me too confused to allow it. It was often possible to see very varying weather conditions simultaneously at different places within our view. For instance, at one time a bank of heavy nimbus cloud overhung Cape Bird; the northern slopes of the western range were in calm and sunshine; clouds of drift were being swept from the slopes of the *Discovery* by a southerly wind. The wind was south-east at the ship, whilst off Cape Armitage and a mile or two to the eastward of our peninsula it was again calm. The same confusion was shown by the snow-waves. As a rule, in the vicinity of the ship they pointed to the south-east; outside White island they were very confused, from west-south-west to south-south-east; south of White island and to the Bluff they were south, at the depôt south-west, and off the eastern slopes of Terror again south.

At the eastern end of the barrier the winds we experienced were certainly east and south-east, but if this is the prevalent direction over the whole barrier, it is difficult to see where the body of air goes to unless it turns to the north on arriving at Victoria Land; it certainly does not go over the mountains and plateau. It is certainly deplorable that there should be no way of measuring the Antarctic snowfall. The most efficient instrument, however, would have been useless in the vicinity of the ship, as our small bay was a focus which received far more than its due share of snow. When the ice about Cape Armitage was a year old, it occurred to me that we might get a rough idea of the net annual deposit by measuring the depth of snow at various points on its surface. This was done with difficulty, owing to the sastrugi and varying nature of the snow, but I calculated that a rough average of the results would represent between 4 and 5 inches of hard-packed snow. Rough as it is, this figure is something of a guide, for it means that the surface of the barrier is annually augmented by about this amount. It may be added that excavations into the surface of the barrier invariably revealed a succession of crusts at irregular intervals. The amount of snow between

the crusts was not much in disagreement with the deposit above mentioned. Even an annual increase of this amount would account for an absence of boulders or dirt in any visible portion of the barrier edge.

In mentioning the deposition on the barrier, I cannot refrain from carrying the same problem to the ice-cap and hazarding a solution for a curious condition of the surface which puzzled me much at the time. In journeying to the west we crossed numerous slight inequalities. Where the surface inclined to the east, it was covered with hard sharp-edged sastrugi, but elsewhere it was quite smooth and covered with a shiny crust traversed by innumerable transverse cracks, which gave it a scaly appearance such as may be seen in the mud of a dried pond. I felt at the time that this was no recent formation, but it was only much later that it occurred to me that this might be a sign that there was no net deposit of snow on this great plateau, or, in other words, that the climatic conditions were such that the evaporation equalled or exceeded the deposition. Before quitting the subject of meteorology, which I am very loathe to do, I must add that the warm snow-bearing southerly winds which we experienced have not yet been explained. Even in the depth of winter this wind had sometimes a temperature of $+10°$ to $+15°$. Presumably the air was in the process of being rapidly cooled, and was depositing its moisture. If it had been heated adiabatically, whence comes the moisture? Mr. Royds may have had some such idea in his mind when he spoke of a "föhn" effect, and I am not quite clear as to Mr. Shaw's reference to this. He remarks, "Wind in those regions may carry snow with it without being necessarily a very moist wind." If this implies that the snow was only drift-snow, I fear he is not quite apprised as to the conditions. Although it was impossible to measure the snowfall, it was generally easy to distinguish between snowfall and snowdrift, and in the case of our southerly winds there is no doubt whatever they are accompanied with falling snow. It will be noted, also, that a comparatively warm southerly wind brought snowfall on the summit of Victoria Land, and at our farthest south position we experienced precisely the same effect.

I must regret that since my return to England I have not had time to keep myself fully informed of the progress of the scientific work of the expedition, in which we all, whether scientists or laymen, must continue to take a deep interest; but we know that it is in good hands, and can hope that the best will be made of the raw material which has been brought back.

It is a disappointment to all that Mr. Ferrar's fossils should not have been in a fitter state for identification, but it is some consolation to know that it is the fault of nature, and not of the discoverer, that they should tell so little; and it is a great satisfaction to find that geologists have already found so much that is interesting in Mr. Skelton's photographs and in Mr. Ferrar's brief summary, that we may look for much

light being thrown on the geological formation of this great land mass when the latter's voluminous notes are brought into shape. Mr. Ferrar has already described how he found an immense sandstone formation, 2000 feet in thickness, practically horizontally bedded on a granitic base and capped with basalt; the simple horizontal structure seems to have been wholly unexpected, and the absence of lateral pressure in the formation of such a huge and extensive range of mountains appears most remarkable. It cannot but be regarded as singularly fortunate that we should have found such an excellent natural geological section of the range as was exposed in the steep cliffs of the Ferrar glacier, and if the simple formation thus discovered be regarded as typical of the whole mountain range (and there is some evidence that it may be), the geology of the Antarctic continent will have received an immense addition.

The more recent volcanic outburst which has thrown up the high conical peaks of Erebus, Terror, Melbourne, Discovery, and a thousand minor craters along the coast-line, must also be of great interest. It occurs to me to add here that geology will owe much to the careful charts which are now being prepared by Lieut. Mulock from a very large amount of survey data.

I am glad to have been informed that an unfortunate error with regard to the hours named for term day magnetic observations is not of such importance as was at first imagined, and, of course, the curves taken under normal conditions are of unimpaired value. It must be long before the full magnetic results are known, but Captain Chetwynd has already found that the observations for "variation" taken at sea and on sledge journeys work in remarkably well.

Dr. Wilson's work on vertebrate zoology, in a region where vertebrate zoology ends, is already fairly well known, but all who have listened to him or have seen his sketches must realize that he will have much more yet to say on his subject. Mr. Hodgson has already furnished a preliminary paper to this Society, and his work must necessarily take a long time to investigate.

I am not aware of the fate of the seismic, the pendulum, or the auroral observations, or of those taken for atmospheric electricity; but as I know all were taken conscientiously, I feel sure all must be of value. I am also in ignorance at present with regard to tidal observations; very great care was taken to eliminate or to allow for all chances of error in these observations, and it is therefore to be hoped that they will yield good results.

Time has obliged me to leave many interesting points untouched in this paper, but I must briefly refer to our geographical exploration to the northward and westward of Cape North. I have already shown the probable cause of Ross's error in imagining the Russell islands to be a separate group from those discovered by Balleny, and I have

same time to have a disappearance of the ice both in the north and south. This tells strongly against the theory of alternating glaciation, and alternating inter-glacial periods. Of course, there are very many other points which we shall have to consider, but I mention these, and I hope that Captain Scott will give us the benefit of his opinion upon them.

Dr. MILL: At this hour of the evening, I cannot profitably add anything to what has been said by the other speakers, but I cordially agree with them in their remarks as to the problems that have been elucidated by the researches of the *Discovery*, and as to the other problems that have been raised and remain for future solution. I am particularly in agreement with what Dr. Teall said as to the extreme importance of the expedition being in due time followed up by another. There should be continuity in carrying forward that research which begun at the time of Cook, 130 years ago, and has since proceeded step by step, every fresh expedition building itself upon the experience of its predecessors. There are one or two statements in Captain Scott's observations which interested me especially, because he has, entirely independently, come to conclusions with regard to the causes of the Antarctic icebergs and the ice barrier similar to those suggested by his predecessors a long time ago; the most interesting of all is that of the great barrier being entirely afloat, confirming in a remarkable way the reflections of Biscoe that Antarctic icebergs were the result of frozen sea-water and the fall of snow "accumulated with time." All these problems could stand a great deal of discussion, and this they will undoubtedly receive; but this evening, I am afraid, is hardly the time for entering upon any new matter of a controversial nature.

The PRESIDENT: Mr. Teall has suggested that birds might be near the south pole. I think Mr. Bernacchi would be able to tell us that, if it is the case. He saw a white petrel flying due south, and obviously it had some object in view.

Mr. BERNACCHI: I am afraid I did not quite catch the point of the President's question, but with regard to the white petrel that we observed on the ice-barrier, it was seen while on the sledge journey undertaken by Lieut. Royds and myself across that barrier, and nearly at our farthest point south-east from Mount Erebus—that is, at a distance, I should think, of 120 miles from the sea. What it was doing there I have not the slightest idea, nor have I the slightest idea where it was going.

Captain SCOTT: I would remark again that I do not claim to have actually proved that the Great Barrier is afloat far to the south, I merely point to strong suggestive evidences; but I cannot quite see why Sir John Murray should limit its flotation to 30 or 40 miles. If it is water-borne for 30 or 40 miles, why not for 100 miles or more? Mr. Lamplugh's questions are difficult to answer verbally and at short notice. With regard to the possibility of an ice-sheet being formed in an enclosed sea without its being fed from a mountainous country, I can imagine, without being an expert, that such a thing would be quite possible. I see no reason why an ice-sheet should not be formed at a low level in the same manner as it is formed on the high plateaux of a mountainous country given similar climatic conditions. With reference to the possibility of the north arm of the Ferrar glacier having been a feeder rather than an outlet of the glacier basin, I fear my remarks must have been obscure, as they did not convey the fact that in this valley we were travelling downwards and towards the sea. I think if I were to explain the topographical features to him, it would leave him in no doubt that the valley ended at the sea, a few miles beyond where we saw it, and that the glacier was an outflow which had wasted back. I am not very clear with regard to the third question concerning the inter-glacial period. If it suggests the possibility that the ice has receded and is now again advancing, I would reply that I

think there is no doubt that this is not the case. The rate at which the ice is now melting, coupled with the absence of movement, points to a present-day recession. Of course, there are a great many facts which I have not been able to enter upon to-night which would bear upon the subject.

The PRESIDENT: It only remains for us to thank Captain Scott for his most important and interesting paper. He has thrown great light upon a most important part of the Antarctic Regions. He has given us a new standpoint whence to draw conclusions on the geography of the whole region. I propose to you, and I am sure you will join with me in passing, a very cordial vote of thanks to Captain Scott for his most valuable paper.

Mr. W. N. SHAW, F.R.S., sends the following remarks :—

I am glad of the opportunity of adding to the remarks I made with reference to Mr. Royds' paper, since Captain Scott has referred to them, and has raised some questions with regard to them. The first point is whether the winds at the winter quarters can be regarded as merely local winds. The best evidence with regard to this would be the barometric gradient. If the average barometric gradient is northward, there will be some kind of easterly drift. I do not yet know what evidence there is about the gradient, but in the mean time it is gratifying to know that the direction of the wind was most frequently from some easterly direction, because it points, in so far as it points at all, to some sort of circulation from the eastward about the pole of cold.

The other point I wish to refer to is the possible occurrence of snow in a dry wind. Parenthetically I may say I should be glad of Captain Scott's method of distinguishing between drift snow and falling snow, but it would not be important for this question, which, I take it, is really the question whether the air through which snow is *falling* is the air in which it has been formed. The answer of any physicist to the question put in that way is "Certainly not;" but to the further question whether the air through which the snow is falling is similar, as regards humidity, to the air in which the snow was formed, the answer is not so easy. It is sometimes difficult to believe, when we get rain here with an easterly wind, that the raindrops are formed in the easterly current, and not in some upper current. And snow is even more likely to find itself carried along in a surface drift in which it was not formed. For the humidity we have still some unsolved problems about the dryness of air over the sea, and we know so little about the conditions of evaporation and saturation at very low temperatures that it would not be wise to assume that we know the hygrometric state of the air from the fact that it is carrying snow-particles.

II. NOTES ON THE PHYSICAL GEOGRAPHY OF THE ANTARCTIC.*

By H. T. FERRAR, M.A., F.G.S.

THE following notes do not in any way pretend to be complete, but are intended to be an introduction to the physical geography of the area allotted to the *Discovery* in the international scheme of work in the south polar regions. No geological sequence is given, but the rocks are considered in the order in which they occur in the field, and this order may be taken as a guide to the relative ages of the rocks.

* This and the paper by Lieut. Royds were read at a meeting of the Research Department on February 6, 1905.

The maps indicate the positions from which specimens were obtained, but cannot be taken as accurate; nor can the height at which the ice once stood be considered exact, for all the evidence on this point has not yet been collected together.

If you will allow me to read my paper instead of lecturing from notes, I shall be greatly obliged; for I find that in lecturing the great difficulty is to bring the main points to notice, giving due prominence to each in turn. There are many points, such as the "Structure of the ice," or "Ice as a geological agent," which I have had to ignore entirely, for want of space; but these and many other points, I hope to be able to enlarge upon later.

The History.

Captain Cook, in 1774, circumnavigated the Earth in high southern latitudes, proved the existence of a circumpolar ocean, and showed that in all probability there was a great mass of land there. The most striking information he obtained was the isolation of the mythical Antarctic continent, but it was in about 110° W. long. and 71° S. lat. that the evidence of the presence of land was greatest; however, no more definite knowledge as to the amount of land in high latitudes was obtained until the Australian whaling fleet made inroads into these unknown seas. It is noteworthy that every expedition tends to show the amount of land to be less and less, although there is hardly room now, as so much is known, to decrease the size of the Antarctic continent to any great extent.

Land was discovered at or near the antarctic circle by the whalers Kemp and Balleny * early in the nineteenth century, but it was not until 1839 and later, when an international attack was made on the south polar regions, that the nature of the land could be guessed at. The Russian expedition, under Bellingshausen,† and the American squadron, under Wilkes,‡ augmented Cook's work; but the first geological specimens were obtained by the French expedition under Dumont-Derville,§ when a landing was made on what is now known as Adèlie Land. Balleny, the captain of one of the ships of the enterprising Enderby of London, and Weddell of the same firm, made important inroads into the Antarctic, which have been subsequently used by exploring ships, but need not be mentioned here, as this paper proposes to deal only with South Victoria Land.

This land was discovered by the Ross ‖ expedition (1839–1841), and his discoveries may be summed up thus—

1. An extensive range of mountains of very great altitude, abutting the open sea, and ending very sharply in that sea. Ross's ships, the *Erebus* and the *Terror*, were not near enough to prove the continuity of the whole, nor to see any structure in them.

2. An open sea, with comparatively shallow soundings, but which shelved to great depths in about lat. 65° S., as if off the edge of a continental shelf.

3. Volcanic cones, or strictly volcanoes, one of which, Erebus, is still active.

4. A great wall of ice, 470 miles long, and of varying height, with a sheer cliff-face, facing the north.

5. Specimens of rock from the Possession islands. One specimen is a hornblende basalt,¶ and, owing to the nature of this rock and to the presence of

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* *J.R.G.S.*, London, 9 (1839), 517-526.

† 'Journal des Voyages,' 14 (1822), 126-128. Book published, 1831.

‡ 'Wilkes' Narrative.' Philadelphia: 1845.

§ 'Histoire du Voyage.' 1845.

‖ 'Voyage to the Southern and Antarctic Regions.'

¶ Teall, Jermyn Street Collection.

THE EDGE OF THE ROSS ICE-SHEET.

PINNACLED ICE FLOATING IN MCMURDO BAY.

mountains such as Erebus and Terror, McCormick decided the whole range was of volcanic material.

In 1874 H.M.S. *Challenger*, under Nares, crossed the Antarctic circle, and, in dredging, obtained specimens of archæan rock, which made it probable that these rocks formed part of the Antarctic continent. Specimens of quartzite are recorded from the Possession islands,* from Cape Adare, as well as in the *Challenger's* dredgings, but no importance was attached to these finds.

The *Southern Cross* expedition, which was the first to spend a Winter in South Victoria Land, to some extent amplified the observations of Ross, as regards the volcanic rocks; but in addition this expedition brought back Palæozoic quartz grits,† but unfortunately no fossils were found in these, though they are undoubtedly of sedimentary origin; also plutonic rocks, such as granites, but no specimens of these had been recorded *in situ*.

The Rocks found.

A landing was made from the *Discovery* on Cape Adare on January 9, 1902, and a collection, chiefly of volcanic rocks, was made; but there was no suspicion of the presence of other than igneous rocks until, in the operation of dredging near Coulmon island, several white fragments of granular quartzite were brought up. The probability of the presence of a sedimentary rock was further increased by sighting, just south of Mount Melbourne, a typical tabular mountain with what may turn out to be bold escarpment slopes; and again, when a landing was made in a harbour in lat. 76° S., on a denuded granite massive, small boulders of quartzite were found. On Mount Terror, basic lavas, granite boulders, tuffs, and quartzite boulders were found, but still there was no sign of sedimentary rock *in situ*.

When Lieut. Armitage, in December, 1902, made his pioneer journey into the Royal Society range, he found a horizontally bedded rock of great thickness exposed along the whole length of the ice-stream, but eventually disappearing below the inland ice, and brought back specimens of quartz grit, so that now the presence of a sedimentary rock *in situ* in the vicinity of our winter quarters was an established fact.

In addition to the above rocks, phonolites were found in several localities on the islands around Winter Quarters, and a coarse tuff, similar to the Possession island palagonite tuff.‡ occurred as a prominent crag bursting through the snow on the south side of Mount Erebus.

In the Royal Society range, at a later date (November, 1903), a gneissic platform was found, which is probably of archæan age, and above it occur the following rocks in order from below: granites, sandstone, basalt.

The granites appear to be of two ages—the one is peculiar in having a horizontal upper surface, which can be seen stretching for 15 miles without a break; the other appears to be intrusive, but its exact position has not yet been determined.

The sandstone, which I propose to call the Beacon Sandstone Formation, is 2000 feet thick, and appears to cover an area of 50 by 20 miles, and possibly ten times as much, but there is no direct evidence for this.

The basalt caps the Sandstone over a considerable area, and forms the well-known plateau feature so characteristic of that rock.§ The original plateaux have been dissected by denudation, and probably also broken up by faulting.

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* Prior, *Min. Mag.*, 12, "Antarctic Rock-specimens."

† Prior, "Southern Cross Collections," *Brit. Mus. Nat. Hist.* publication, p. 325.

‡ Prior, *Min. Mag.*, 13, "Antarctic Rock Specimens."

§ Harker, 'Skye Survey Memoir,' plates ix. and x.

The basalt forms the highest ground that has been ascended in South Victoria Land, and in addition it occurs as dykes and sills in the Sandstone, and is, therefore, evidently a younger rock. It is first met with near the 7000-foot contour, and is also seen at the Depôt Nunatak, 8000 feet above sea-level. It appears to be columnar throughout, and numerous columns up to 12 feet in diameter and perhaps 500 feet high were observed 80 miles from the sea and 120 miles from the ship.

The fossil plants were found close at the base of the basalt in a thin carbonaceous seam not more than $\frac{1}{8}$ of an inch thick. After my party, Kennar, P.O., and Weller, A.B., had been laid up for six and a half days on the edge of the inland ice, we made our way back to Depôt Nunatak, which we could only get occasional glimpses of through the snow-drift. Here we spread our gear out to get rid of the snow accumulated in it during the lie up, and in the moraine I found very suggestive traces of organic matter. I at once made across the South-West arm of the great glacier we had ascended, to a spot where the Beacon Sandstone could be seen just appearing below the "capping" basalt. We arrived at this spot, had lunch, and imagine my delight, when taking my bag and hammer up to the rock-face, to find this "coal-mine," as I may call it, staring me in the face. Finding the seam to be much charred, I set off next day diagonally down the valley to a spot on the left bank of the glacier where 2000 feet of the sandstone was exposed, and of this, 1500 feet proved to be accessible, and was examined.

However, no better specimens could be obtained, neither could the base of the sandstone, nor the platform on which it rested, be seen here or at any other spot visited during this memorable sledge journey.

The Topography.

South Victoria Land consists of a great range of mountains, which reach in an almost continuous belt from the latitude of Cape Adare to the latitude of Mount Longstaff, a distance of 800 miles or so. The heights vary from 15,000 feet, of which there are three or four peaks of that height, to 4000 feet, and it is remarkable that there is no extensive area of land of a less height than 4000 feet.

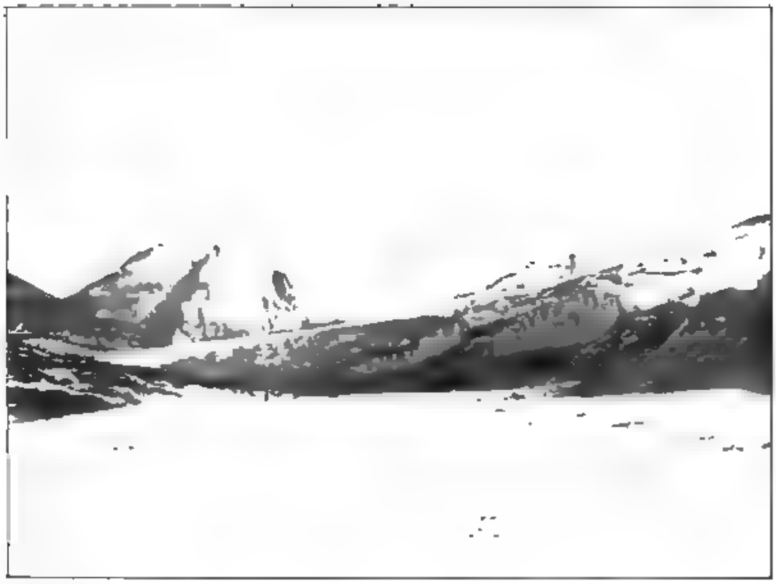
This range appears to be the eastern extremity of a great mass of land, and buttresses a vast interior ice-field,* traversed for 200 miles by Captain Scott in a westerly direction. Captain Scott found this inland ice to be of an almost uniform level, and to maintain this level at a height of 9000 feet above the sea. This inland ice drains into the sea through valleys at right angles to the length of the mountain range (see the charts published by the Royal Geographical Society), and in this way gives rise to two of the largest glaciers in the world.

In the latitude of Cape Gauss (I use this term, as nothing very definite has yet been fixed on this part of the coast) the land falls to only heights of 4000 feet, and there is a long stretch of coast which is very similar to the west coast of Greenland, and made familiar to us in Von Drygalski's detailed work of that area. These features are: a comparatively narrow belt of inferior height, ending sharply at the sea-front, through which glaciers or ice-streams (if we use Drygalski's nomenclature) break, on their way to the sea from the inland ice. These ice-streams are very similar to those of Greenland, in that their length between the land forming their sides is more nearly equal to their breadth than is the case with Norwegian or Alpine glaciers.†

In addition to the main mountain range of South Victoria Land, we have isolated volcanic cones or volcanoes, though only one, Mount Erebus, is now active.

* Bernacchi, 'To the South Polar Regions.' 1901.

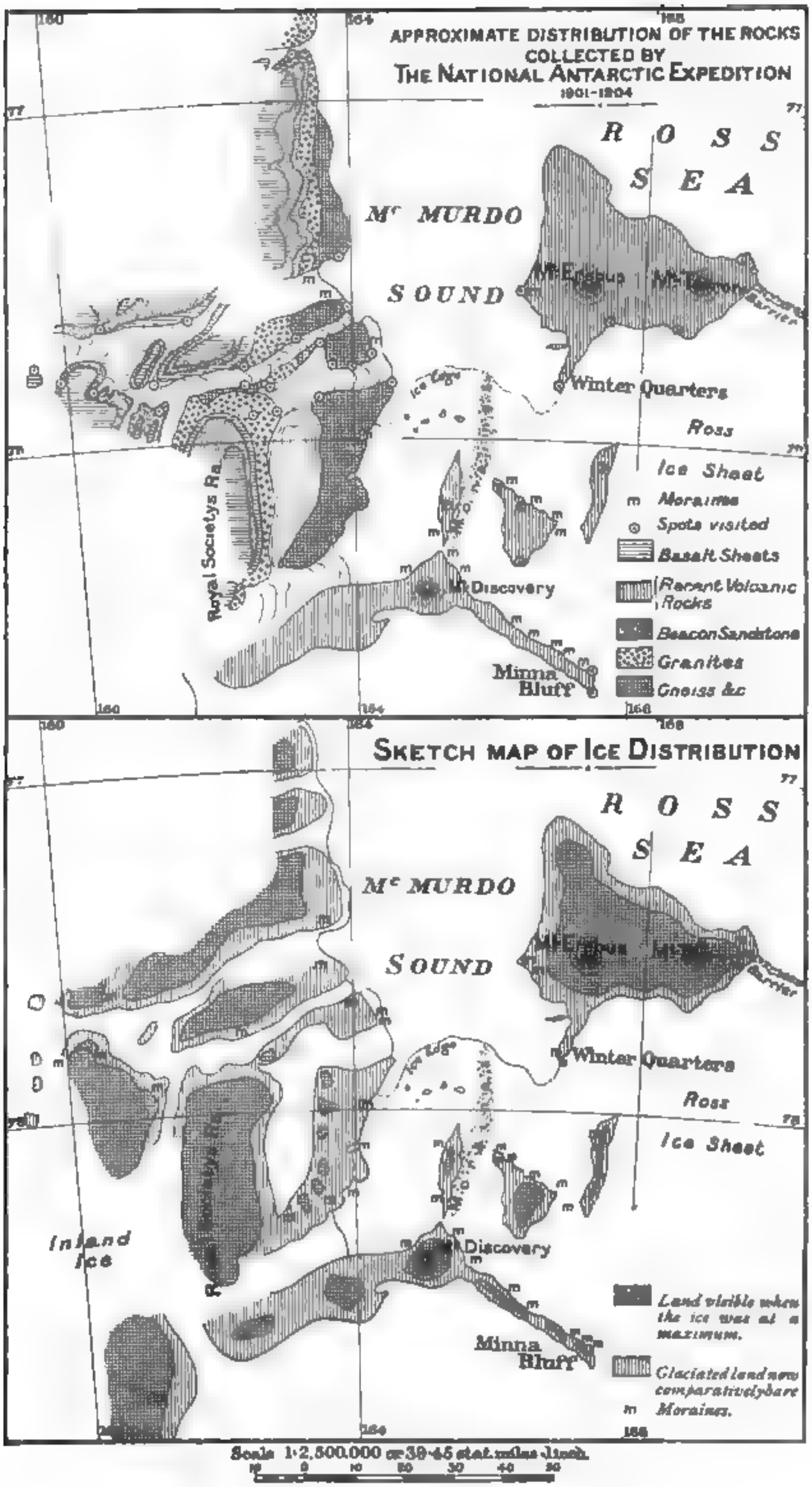
† Heim, 'Gletscherkunde.' Stuttgart: 1885. Classification of Glaciers.



THE CHANNEL BETWEEN THE ICE AND THE BARE ROCK.

BEACON HEIGHTS — SANDSTONE AND BASALT.

LOOKING UP FELDSPAR GLACIER FROM THE ENTRANCE.


APPROXIMATE DISTRIBUTION OF THE ROCKS
COLLECTED BY
THE NATIONAL ANTARCTIC EXPEDITION
1901-1904
ROSS
SEA
Mc MURDO
SOUND
Winter Quarters
Ross
Ice Sheet
m Moraines
Spots visited
Basalt Sheets
Recent Volcanic Rocks
Beacon Sandstone
Granites
Gneiss &c
Royal Society's Ra.
Mt. Discovery
Minna Bluff
SKETCH MAP OF ICE DISTRIBUTION
ROSS
SEA
Mc MURDO
SOUND
Winter Quarters
Ross
Ice Sheet
Inland Ice
Mt. Discovery
Minna Bluff
Land visible when the ice was at a maximum.
Glaciated land now comparatively bare
m Moraines.
Scale 1:2,500,000 or 39·45 stat. miles :1inch.

These volcanoes as a rule lie at the base of the mountain range, in comparatively low land, and as often as not slope down directly into the sea. They are all conical, though not so steep as those of Japan, and several have craters at their summits, as is proved by the cone being truncated. They are all of considerable height, and can be seen to cover large areas if reference is made to the charts.

Mount Erebus, 12,760 feet high, shows three marked stages in its growth—

(*a*) The lip of a huge crater, running round it as a girdle at a height of about 6000 feet above sea-level.

(*b*) A second lip, at an altitude of 10,000 feet, of a younger crater, from which streams of lava have welled up and flowed down its sides.

(*c*) The present small cone,* built up asymetrically inside the second lip, and from which the steam now issues.

Mount Terror, like Mount Erebus, is completely covered in snow, except in the more exposed spots, where either the wind blows the snow away, or the slope is exposed to the sun, which evaporates the snow as fast as it falls. This mountain is 10,884 feet high, and has a perfect crater rim at its summit, probably half a mile across; there are also occasional parasitic vents on the east side of Terror, but on the south and west sides the covering of ice and snow is so heavy that vents, if present, could not be distinguished.

Mount Discovery, like the two former, is thickly covered in snow on the south side, though on the north side it is practically bare. This mountain stands on an almost circular base, and is connected to the mainland on the west by a low dome (Mount Morning). This latter forms the right bank of the Koettlitz glacier, which flows out to the north into McMurdo bay, along the base of the Royal Society range.

Mount Melbourne, 8560 feet, the last of the volcanic cones which I will mention here, like the rest, is isolated, but lies more among the mountains than do the others, except, of course, Erebus and Terror, which form an island of themselves. It is rather steeper than the others, tapering up almost to a point, but, being truncated, probably has a crater at its summit a quarter of a mile in diameter. On the north side it rises sharply out of Wood bay—one of the largest indentations in the comparatively straight coast-line—while on the east it stretches out into a long promontory, namely, Cape Washington.

Before going further, I should like to put on record the great help I obtained from all my companions, and to say how I appreciate that help. It can at once be seen that it was impossible for me to have travelled over all the localities mentioned in this summary, and as it is impossible for me to name the source of my information in each case, I must refer my hearers to the charts and the sledge journeys for details on any particular point.

The Land Ice.

Contrary to expectation, the ice was found to be developed on a comparatively small scale,† and not, as was expected, covering the whole land surface, except for a few isolated peaks or nunataks.

The form of the land surface accounts for this to a great extent, for having an almost continuous cliff-face, on an average 10,000 feet high, facing the open sea, the amount of precipitation would have to be excessive to build up and fill in with ice the valleys at the base of the cliff-face.

It is true that in the vicinity of Cape Gauss, where the land is only 3000 or 4000 feet high, the features are similar to those of Greenland,‡ namely, a fringe of

* Scrope, 'Volcanoes,' sketch of Aetna, p. 190.

† A Geikie, 'Text-book of Geology,' p. 418; and Croll, 'Climate and Time.'

‡ Drygalski, 'Greenland Expedition,' p. 159.

land almost snow-covered, behind which lies an extensive area completely covered in snow and ice, or inland ice, as it has been termed. Further south, however, where the land rises to heights of 12,000 and 15,000 feet, typical glaciers occur, always on the east side of the mountain range, having their gathering ground or firn-fields among the higher peaks, and flowing out into the foothills through valleys.

It is remarkable that some of these glaciers do not reach the sea, but end 2 or 3 miles from it, and at altitudes of 2000 and 3000 feet above it.

On the west side of the summit of the range the land appears to fall away, and the whole becomes covered in snow; the bare mountains have their place quickly taken by isolated nunataks, and these are only found 5 or 6 miles to the westward of where the mountains properly end.

This inland ice finds its way to the sea through valleys which cut right through the mountain range, and the great ice-streams thus formed are usually of bare ice, for the winds that blow down them appear to sweep away any loose snow that may have fallen, and it is only near the terminal faces that any thickness of snow is found. On the other hand, the more protected glaciers in the mountain range, as a rule, have a significant snow-covering.

Running water was, as a rule, conspicuous by its absence, for it was only in the channels between the side of a glacier and a bare rock surface that any water could be seen, and then only in the two summer months proper, December and January.

All water that has been seen could be accounted for directly by melting alone, due to radiation from the sun, as all of it was due to surface thaw, and none to the internal heat of the glacier or the Earth's surface. After a summer snowfall, running water does take a small part in the cycle of seasonal change, for the snow falling on bare stony ground, such as Black and Brown islands, is quickly melted by the sun, and runs off to lower levels in a constantly increasing stream—so much so that large areas among the moraines at the base of Mount Discovery and Brown island are completely inundated.

Under this head, namely, The Land Ice, we must include the ice-sheets, of which there are at least three in South Victoria Land, namely, Ross' Great Ice-sheet or barrier, the ice-sheet in the vicinity of Cape Gauss, and, thirdly, the ice-sheet filling up Lady Newnes bay.

All these have as characteristics a horizontal upper surface of great extent, which may or may not be undulating (cf. the Humboldt glacier in Greenland); a seaward cliff or face of ice, almost absolutely perpendicular, and varying in height between 50 and 200 feet; and water at the base of this cliff, which is, without a doubt, deep enough to float the ice. For details, see the charts published in the *Geographical Journal*, August, 1904.

The Old Moraines.

Ice-scratched stones and doubtful erratic blocks were seen on the slopes of Mount Terror above Cape Crozier; but it was not until Dr. Wilson, following in the footsteps of Lieut. Royds overland to Cape Crozier from Winter Quarters, found what is probably an old moraine, high above the level of the Ross ice-sheet, and proved the ice-sheet to have been once higher than it is now.

There was other, though unsatisfactory, evidence of this greater height of the ice-sheet near the summit of White island and around Winter Quarters, but the old moraines above Cape Crozier put all doubts at rest.

Other old moraines occur in the channels between Black island, Brown island, and Mount Discovery, and as a rule hug the shore, as do ordinary lateral moraines.

And, again, on the top of Cape Adare erratics and old moraines occurred, which could not but have been formed by a greater extent of ice than obtains at present. Therefore the ice is near a minimum, which is rather a surprising conclusion to arrive at. I am not prepared to discuss the observations of others in North Polar regions, but would like to draw attention to such statements as—

1. Prof. Garwood's (*Q.J.G.S.*, vol. 55, November, 1899, p. 688), that the snow-line of Spitzbergen, in 78° N. lat., is at an altitude of 2000 feet above sea-level.

2. Von Drygalski's,* that the Greenland ice is receding, and it would require a warmer and more humid climate to extend the glaciers to their once greatest extension in his latitude, 72° N.

3. Dr. Schei's, that the ice of Grinnel Land is at a "maximum," and accompanies this statement with a photograph (*Geographical Journal*, July, 1901, p. 65), showing a moraine 50 feet at least above the level of the glacier. Dr. Schei's latitude north was very nearly our latitude south, namely, 77°.

All my evidence as regards the advance or retreat of the ice in South Victoria Land points the same way, namely, a retreat which is going on at the present day. This is exemplified again by the fact that the Ross ice-sheet, though moving 100 feet a month to the northward, has retreated on an average 15 miles during the last 65 years. These, and other points too numerous for this short paper, should be discussed in their relation to the Great Ice Age of Europe and the Great Glacier Period in New Zealand.†

The Sea Ice.

The sea ice that has been seen presented nothing of special interest in its formation or behaviour. McMurdo bay was guarded by a line of pack-ice from Cape Bird westward. When the *Discovery* entered the bay in February, 1902, this line had to be cut before the open water was reached, this open water not freezing over finally until May, although it had been practically frozen in April. The bay remained covered in a uniform sheet of ice until February, 1904, when a general break-up took place.

The ice as a rule does not attain a thickness greater than 8 feet by direct freezing, but where snow accumulates locally the thickness produced in a season may be as much as 40 feet. So also, locally, direct freezing will produce a thickness of 12 feet where the land prevents a rapid circulation of the water; and, on the contrary, where there is known to be a strong current, the ice, though freezing to a thickness of 8 feet during the winter, will be completely melted through during the summer.

The salinity of the sea-ice ‡ is very variable, and seems to depend upon the rate of freezing more than upon the depth or distance from the upper surface. In many cases where the ice-floe was hummocked up, bands could be seen which were of different hardness as regards the action of wind and water. These bands all had different percentages of salt, and the thicker bands, which had been frozen quicker by a sudden fall in the external temperature, were found to contain more salt than the thinner bands.

Denudation.

Denudation, at the present day, on the whole plays a comparatively unimportant part in determining the features of the landscape. It is true that the Royal

* 'Greenland Expedition,' p. 33.

† Hutton, *Trans. N.Z. Inst.*, 5, 384.

‡ Axel Hamberg, *Bhang Till K. Svenska Vet.-Skad. Handlingar*, Band 21, Afd. II. No. 2, p. 5.

MORAINE ON WESTERN SHORE OF MCMURDO BAY.

A HOLLOWED GRANITE BLOCK

Society range does show rounded rock surfaces due to the grinding of ice, or the rock matter carried along by ice, but in the vicinity of Winter Quarters none of this "ice-work" has been seen. The splitting off and cracking of large masses of rock due to the percolation of water, which expands on freezing, gives evidence of at present being the most important factor in the denudation of the land. Examples of this kind are well illustrated in Castle rock and the Cathedral rocks of the Royal Society range.

Water plays an unimportant part in some localities, while generally the work of running water of the present day is absent altogether. On the eastern side of Brown island there are several gullies cut out in the hillside by the water from the snow-fields flowing down to a lower level, and as water in any quantity has only been observed during two months of the year, its resultant effects are very marked.

Wind is an important factor in denudation, for both at Winter Quarters and in the mountains of the mainland its effects were observed. At the former locality some rocks were polished and pitted in the ordinary manner, but in the latter granite blocks were gnarled and hollowed * in a unique manner.

The surface around the harbour where the ship lay is composed of loose stones. Under them and mixed with them is the dust due to the disintegration of the rocks; and at some points a rock can be seen to crumble gradually until it becomes a mass of impalpable powder. This powder, however, cannot remain on the surface, and is, as a rule, protected from the wind by a covering of loose stones.

The Movement of the Ice.

There were few opportunities for measuring the movement of the ice, as there was no glacier within 20 miles of the ship, and the nearest glacier that could give any fundamental results was 40 miles away. When the ship first anchored, it was seen that the Ross ice-sheet exerted a certain pressure against the Winter Quarters peninsula, and the first party to Cape Crozier overland brought back tidings of huge ridges pressed up against the base of Mount Terror. However, a good measurement of the movement of the Ross ice-sheet over a long interval was obtained by a sledge party visiting Captain Scott's Depôt A, off the Minna Bluff, a year after it was laid down. The following brief results are inaccurate, as most have been obtained by hearsay, and have not been checked by angles yet; but they will serve the purpose here of showing how extremely slow the movement is, especially when compared with observations of others in the Arctic Regions :—

1. Blue glacier (Norwegian type), 1 inch per month.
2. Ice tongue in Erebus bay, 3½ feet per month.
3. Ferrar glacier (Greenland type), 5 feet per month, winter months; 12 feet per month in the warmest month, December.
4. Ross ice-sheet (Depôt A), 100 feet per month; overflow at Pram point, 8 feet per month.
5. Spitzbergen (Garwood), 800 feet per month.†
6. Karajak glacier (Drygalski), 1500 feet per month.‡

In conclusion, attention must be drawn to the action of ice as a "conservative agent."§ The ice-foot, which so many writers quote as carrying matter out to sea, we found to remain firmly fixed to the land, and to act as a "selvedge" edge does to a piece of cloth, *i.e.* strengthen it and retard wear and tear.

It may be remarked that the snowfall during the two years has not been

* F. F. Tuckett, *Geol. Mag.*, January, 1904.

† *Q.J.G.S.*, vol. 55, 1899, p. 686. ‡ 'Greenland Expedition,' Band. 1, p. 263.

§ Bonney, *Geo. Jour.*, 1893, pp. 481–499; *Proc. R.G.S.*, 1888.

excessive, nor has the climate been so severe * as previous explorers had led one to suppose. The climate may be described as perfectly dry (cold desert conditions), owing to the temperature of the air always being below the freezing-point of water, and this fact goes far to explain the present terrestrial features of South Victoria Land.

Before the papers by Lieut. Royds and Mr. Ferrar, the PRESIDENT said: It is necessary to bring the geographical results of the Antarctic Expedition before the Fellows of the Society in some form which will enable them thoroughly to understand the results and to discuss them, and after consideration I thought the best plan would be to request some of the officers of the scientific staff who were in charge of different departments of work to write short special papers on their own results, and then that the commander of the expedition should be requested, at a large general meeting, to review the whole subject, so that it might be fully discussed. Mr. Royds has kindly undertaken to give us some account of his work in meteorology. Mr. Ferrar will give us some account of the physical geography of that very remarkable range of mountains running nearly 700 miles north and south, and attaining heights of 1500 feet, and certainly not ending where they were last seen. Possibly at a future meeting we may have short papers from other officers. Mr. Armitage's work is, of course, of the greatest possible value, and is mainly connected with the magnetic observations at sea. Mr. Bernacchi has conducted most of the physical observations on land, the magnetic work, and the pendulum observations, with the assistance of Mr. Skelton; Mr. Barne, the tidal observations; and then we rather hope, also, to have short papers from Dr. Wilson on the geographical aspects and distribution of the aves fauna, and possibly a brief note from Mr. Hodgson with regard to a few of the invertebrates. This evening we shall have papers from Mr. Royds on the "Meteorology of the Part of the Antarctic Regions where the *Discovery* wintered," and Mr. Ferrar on the "Geology of the Antarctic Regions." I now call upon Mr. Royds to read his paper.

After the reading of the papers, the following discussion took place:—

Dr. BONNEY, in expressing his sense of the great value of the two papers to which they had just listened, said that in the *Geological Magazine* two accounts of hollow blocks, such as Mr. Ferrar had noticed, had recently appeared—the one describing a case in Corsica; the other, by Mr. Baron, in Madagascar. Both, in granite, were in localities where the action of wind in any form seemed not to be possible; and he did not feel satisfied with any explanation which had been offered, though at present he was unable to propose a better. He ventured to object to the use Mr. Ferrar had made of the term "esker," of which he had examined some good examples, including the noted one at Upsala. In them the stones were generally fairly rounded, and the materials more or less stratified. The photograph which had been shown them, he thought, represented a variety of moraine. These, however, were only trifling criticisms. Passing to the main points of the paper, he thought the most important was that the great ice-barrier, in all probability, did not rest on submerged land, but was afloat. That to him was quite a novel idea; but after listening to Mr. Ferrar's arguments, and as the result, he might add, of a conversation with Captain Scott that afternoon, he did not see how to dispute their conclusions. It was also very interesting to learn that, as had been clearly proved, the ice in the Antarctic had formerly been more extensive, and that a glacial epoch was not now at its maximum in that region. Mr. Ferrar was quite

* 'The Antarctic Manual.' R.G.S. 1901.

right in saying this observation was likely to be far-reaching. The relations noticed between the ice-sheet and the climate were also important. He had always felt difficulties in understanding how, with anything like the present configuration of Europe, that dry "steppe period," which occurred late in the glacial epoch of the north, could have been brought about. But Mr. Ferrar had shown that in the Antarctic something like steppe conditions now was the result of extreme cold, so that an increase of ice might not signify a fall, but a slight rise, of temperature. In other words, that, supposing the temperature to remain below a certain level, the amount of ice, as had been already observed, depended on the amount of precipitation, which, of course, meant the amount of evaporation somewhere else. Thus the smallest amount of snow might correspond with the time of most intense cold. These observations were also likely to be very important. He could only conclude by saying that he had been deeply interested in the paper, and hoped soon to see it in print.

Mr. Teall: I am glad of the opportunity of saying how pleased I am to hear of these wonderful discoveries in the Antarctic Region. As a result of this expedition, the map has not only been modified and extended, but in the observations which Mr. Ferrar has made, in the collections which he has brought home, and in the striking photographs that Lieut. Skelton has taken, we have materials for forming some definite conclusions as to the geological history of the region. It is difficult to speak on this subject without a careful consideration of all the facts that have been ascertained; but I may, perhaps, allude to one or two points that strike me as being of great interest. We have heard of this important mountain range stretching for 600 miles or more from north to south, and containing some very high peaks. At first one might have expected that this range would prove to be of Alpine type with folded rocks, ridged up by lateral pressure; but instead of that, so far as I understand the matter, this high ground possesses a very simple geological structure; and, at any rate in the region examined, is made up largely of thick layers of nearly horizontal sandstone, containing plant remains, associated with great sheets of basalt. What these more or less horizontal rocks rest on is not quite clear at present, but Mr. Ferrar referred to gneisses and granites at a comparatively low level, and it is not improbable, therefore, that they represent the floor. At any rate, the essential feature of this important range is that it possesses a simple tabular structure. These horizontal rocks seem to end off—Mr. Ferrar will correct me if I am wrong—abruptly at the sea-margins. But they must have originally extended far away to the east over the flat ice traversed by Captain Scott in his memorable sledge journey. Is their absence in that area due to removal by denudation, or is it due to the fact that some great structural line runs north and south, along which the rocks on the east have sunk down to a lower level? Are we looking there at a great sunken area? Prof. Suess would probably take this view, and point to the volcanoes as further evidence of this conclusion. One other point. One cannot help being struck with the extraordinary evidences of change of climate. Mr. Ferrar said that rain-water is doing very little in that region now, but it must have played an important part in former times. More than 2000 feet of sandstone with well-rounded pebbles clearly indicate water-action on a gigantic scale, and climatic conditions very different from those which now exist. But there seem to be later evidences of water-action. It is impossible to look at the photographs which we have seen on the screen without coming to the conclusion that we are looking on surface features that have been sculptured by rain and rivers. In the nature of the rocks and in the topographical features, we therefore seem to have clear evidence of climatic conditions totally different from those which now exist.

Dr. Smith Woodward: I will confine my remarks to a brief preliminary

statement concerning the fossil plants. The carbonaceous matter found by Mr. Ferrar is really of great importance, because I think I am right in saying that this discovery was made at a spot no less than 500 miles south of the fossil plants that were brought back by the Swedish Expedition. The Swedes, of course, were able to obtain some satisfactory specimens for determination, but I regret to say that it is quite impossible to make out the new material before us brought by Mr. Ferrar. All who have seen it are quite agreed that this carbonaceous matter must be due to vegetation, but it shows no structure whatever. It has neither surface structure nor microscopic structure, and it seems impossible to determine whether it is due to land vegetation or to marine vegetation. Dr. Scott, of Kew, and Mr. Seward and Mr. Arber, of Cambridge, have kindly examined the material with great care, but no specimens that have yet been studied show any structure. Although, therefore, there is no doubt that Mr. Ferrar has discovered vegetable remains in the sedimentary rocks of the extreme far south, we are unable to determine what they are; nor are we able to make out from these fossils the age of that great sandstone formation of which we should like to know so much.

Mr. Bernacchi: I have a few remarks to make with regard to that fascinating problem—the great ice-barrier. I should like to ask Mr. Ferrar how he accounts for the ice-barrier being afloat. It seems inconceivable to me that anything but the extreme sea-edge of such a vast body of ice should be floating. Near Cape Gauss, some miles to the north of our winter quarters, there is a fairly large body of ice extending for some considerable distance seawards, and presenting in many respects the appearance of the great Ross ice-sheet; it terminates seawards in perpendicular cliffs; the soundings along the edge are approximately the same as along the great ice-barrier, and the surface is comparatively level. Now, it is evident that this ice is land ice flowing through the valleys in the comparatively low land, and spreading out and extending seawards until it reaches water sufficiently deep to float it, when it breaks off and drifts away in the form of icebergs. To my mind the great Ross ice-sheet is formed in very much the same way; it is possibly the accumulated ice-flow of centuries over a comparatively shallow ocean, breaking away continually from its seaward edge, and continually renewed from those huge valleys or gaps seen by Captain Scott in his southern journey, possibly not only from this land, but from land that is found farther south, and takes a trend eastward. I do not know that I have anything more to say, except to ask Mr. Ferrar how he accounts for the ice-sheet being afloat.

Prof. Garwood: So many interesting points, as previous speakers have said, have been brought forward that I do not know which to select. There are one or two questions I should like to ask. One is the question of raised beaches. I do not think Mr. Ferrar said whether there were any raised beaches, and I think it would be very interesting to know whether there are. Another point was with regard to those escas, which, I quite agree with Prof. Bonney, look more like ordinary moraines. Then there was another point with regard to the floating ice, that was whether they came across any flat stones connected with these icebergs. I was very interested when I was at Spitzbergen to notice a large number of stones collected there which only had one flat polished side; and I was interested, on looking at some of the specimens brought from Franz Josef Land, to find a similar feature on those stones. I should be very glad to know whether Mr. Ferrar did notice that feature, because it seems to me it is possible in certain cases to use that as evidence of floating ice. If you find the greater number of stones have only one flat side, it would seem to point towards the action of floating ice, because, obviously, a stone frozen into a solid mass would not be turned round when brought into contact with other objects in the same way as they are in glaciers,

so that only one side would be scratched and polished. With regard to the rate of advance of the ice, certainly it is very striking to note the very slow rate at which this huge ice-sheet is advancing compared with things far north. The other point is with regard to the decrease of the ice. I must say myself I have always been struck with the great difficulty of accepting that theory. Gregory and others have called our attention to the effect of moraines; they are very much lower than the regions at the present day. This same effect coming up again in the Antarctic is a very interesting feature. Well, I won't occupy your time any further, but will express my extreme interest in the work of the expedition.

Mr. LAMPLUGH: There is so much that a glacialist would like to ask on this paper, that at this hour it would probably be best to say nothing. But I cannot refrain from asking just one question—whether the peculiar long straight valley holding a glacier, which we saw in the photograph, has been worn by ice? There is much discussion among geologists as to the erosive power of ice. We seem here to have a waterless land where ice is decaying away, and beneath the ice-sheet we find a great valley of the type that is usually regarded as water-worn. Perhaps Mr. Ferrar will say whether he considers that the ice pouring down the valley has produced the hollow, or whether the feature is supposed to be older than the ice-sheet. This is only one of the many points on which we shall sooner or later ask the investigators to help us in our efforts to understand the conditions which formerly prevailed in our own country.

Mr. FERRAR: I should like to answer Mr. Lamplugh first. That glacier I take to be in a fault valley. Dr. Teall touched on the faults in that region forming the great seaward edge of Victoria Land. If we regard Victoria Land as the original surface, and the Ross sea the downthrow side of the fault, then the coast will be in the fault-plane, with the volcanoes along it. There are many valleys that are similar to that one which appear to be fault-valleys, and run out parallel to one another, but are uncharted, as they have not been traversed. The positions of the rocks in the same sequence on both sides of the valley being at different levels, the steps in the Thalweg and the "capping basalt," faulted down perhaps 2000 feet below the plateau-level, lead to the same conclusion.

I should like to thank Dr. Bonney for telling me of other records of rocks being worn in this peculiar way. The term "esker" I used because it was unfortunately applied by us as a local name, and used as such for convenience only. The cones are only moraines, as Prof. Garwood pointed out, but they lie transversely to the drainage lines. I saw no evidence of raised beaches. It is true, away south, 20 miles from the edge of the sea, and on floating ice which is undoubtedly glacier-ice, we found Balanus shells, but these were amongst morainic cones of ice-scratched stones, and near these cones were several bosses, or mounds, 2 and 3 feet high, of a white crystalline salt (sodium sulphate?). Above Cape Crozier there were certain horizontal ridges of loose material, and on them were granite and quartzite boulders. These ridges I took to be moraines, and this view is further strengthened by Dr. Wilson's observations on the east side, where he found those long horizontal moraines running round the slope of Mount Terror above the great ice-sheet. With regard to ice-scratched stones, in answer to Prof. Garwood's question, I did not examine fragments dredged up with that particular point in view, but there are at the Natural History Museum some hundreds, which may give evidence as to whether stones carried by floating ice are scratched more on one side than on another. I did not attach much importance to the latitude in which the several fossil plants have been found, so long as they occurred south of the circumpolar ocean, but if a few miles is of any importance, I might be allowed to point out

that the *Discovery's* fossil plants were found, nearly twice as far south as Dr. Smith Woodward mentioned, namely, over 800 miles, and at a distance of 2500 miles from those of the Swedish expedition, as well as on the opposite side of the pole. I beg to be excused for mentioning this, but I find the Antarctic Regions are regarded relatively, distances being judged according to the size of the map, and that the great spaces separating the international stations are too frequently overlooked.

As regards the *barrier* being afloat, I think its horizontal upper surface is practically enough to prove its being borne by water. It may, of course, touch or adhere to the land locally, but in the main there is no other condition that could give it this horizontality. Again, the *tide crack* is never absent, wherever it may be looked for. Dr. Wilson found it in the most impossible places when on a sledge journey towards Cape Crozier, and on sledge journeys in other directions. This *tide-crack* is never absent; even on King Edward VII. Land there is evidence of a differential movement between the ice-sheet proper and ice supported undoubtedly by land. Those are some of my reasons for thinking the Ross ice-sheet is afloat.

The PRESIDENT: I should like to ask Dr. Smith Woodward in what way these vegetable fossils have been injured.

Dr. SMITH WOODWARD: I think they have been destroyed by decay. It generally happens that when fossil plants are buried they decay and become carbonized, and most probably these have not only decayed since they were in the rock, but were destroyed in part by drifting and mixing together before they were buried. They look very much like drift vegetation, but owing to the carbonization we can see nothing whatever with the microscope.

The PRESIDENT: I think the two papers * we have listened to, and the interesting discussion that has followed, is the beginning of the garnering of our harvest of results to which we may look forward. The meeting, especially Members of Council who are present, will be interested, I think, to hear that I had a cheque for £10,000 put into my hands this afternoon, which is very much less than the *Discovery* was worth; but, at the same time, it will enable the joint finance committee of the two Societies to bring out all the publications and enable all the work to be done in a most liberal spirit. We must thank these two officers, Mr. Ferrar and Lieut. Royds, for their very interesting communications, and we must all remember with what great difficulties and hardships they had to contend in taking their observations and obtaining these results. Lieut. Royds made a most important and a most difficult journey over the barrier with Mr. Bernacchi, and I think Captain Scott told me that Mr. Ferrar with five others made, next to himself, the longest sledge journey—dragging the sledge—that has ever been made either in the Arctic or Antarctic regions. I think Captain Scott went over 32 miles, and Mr. Ferrar went over 33 miles, in one day. So I think we should be grateful to the two young explorers for the diligence and resolution they showed in obtaining these results. I now beg to propose, in closing the meeting, a hearty vote of thanks to Lieut. Royds and Mr. Ferrar.

* Lieut. Royd's paper was read at the same meeting.

III. ON THE METEOROLOGY OF THE PART OF THE ANTARCTIC REGIONS WHERE THE "DISCOVERY" WINTERED.

By Lieut. C. W. ROYDS, R.N.

THE physical geography of a region is affected in various ways by the meteorological conditions. I had charge of the meteorology during the three years that the *Discovery* was absent from England, including the two years and two months that she was within the Antarctic circle. I have, therefore, been told off to submit a paper on the meteorology of that part of the Antarctic Regions where we wintered, with special reference to its physical geography. I have endeavoured to fulfill this task to the best of my ability, but I am impressed with my incompetence to undertake it.

I need not describe in any detail, the route of the ship during the navigable season of 1901 to 1902, as that has already been done by more competent hands. I need only remind my audience that we passed down the eastern coast of Victoria Land, from Cape Adare to Cape Crozier, examined closely the face of the great ice-barrier throughout its entire length, and discovered high land to the eastward.

Throughout the passage down the coast we experienced more or less light south-easterly winds, except for a very heavy gale from the south-west off Coulman island, which lasted for three days. The winds we experienced whilst passing along the barrier were from the south-east to south-west with few exceptions, and very cold winds they were, as they had passed over the many hundreds of miles of barrier to the southward before reaching us.

It is necessary that I should describe more fully the position of our winter quarters, especially with reference to the amount of shelter caused by surrounding land. The ship was in a small bay of about a quarter of a mile in depth. All round, from north-north-west through east to south-east, there was land rising quickly to some height. In the north-north-west the hills were 400 feet high, and these extended to north-east, and then a hill of 1000 feet in the east, and one of 700 feet in the south-east. Between the east and south-east was a deep gulley, or gap as we call it, which opened out on to the ice-barrier. From south-east through south and west to north-west we were entirely open except for land 20 to 50 miles away. From north-west back to south-west was the Albert range, rising to peaks of 15,000 feet, and to the south were some islands 3000 feet and land rising to 8000 feet.

In our bay there was a very pronounced local wind, namely from an easterly direction, and it was no uncommon thing for one to leave the ship, blowing a fresh gale, and, having walked a mile to the south and rounded Cape Armitage, find it a dead calm. Very many instances of this might be quoted, only time will not permit.

Before proceeding further, I should like to say that any temperatures or barometric readings that are mentioned are entirely uncorrected, and in the case of the means they are not issued as correct from the Meteorological Office, and are only the results as worked out during the time we were in the south. In every case the temperatures are Fahrenheit, and the winds are true.

In speaking first of the temperatures, there is very little to say, on account of the observations not being worked out. The coldest temperature registered at the screen was $-59°\cdot5$ on August 20 of our second year, our first year's minimum being $-50°\cdot5$ in the same month of August. The corresponding maxima for the two years were $+39°$ in 1902 and $+42°$ in 1903, curiously enough on the same day each year—December 26.

It was unfortunate that, on account of the ship being left with so few hands from November, 1903, to February, 1904, night observations had to be discontinued, and so I am unable to compare the monthly means of the two years. This will be done; as, although we have not the eye-observations for those few months, we have the records of the self-recording instruments the whole of our stay in those regions. At one time I thought of trying to compare our temperatures with observations of other expeditions, but on looking into it, I decided that they were not comparable, except in the case of the Cape Adare observations. All the remainder were movable stations, and were taken at sea, whilst ours and the Cape Adare ones were fixed land stations.

In comparing the first year's means with those of Cape Adare, one finds that the difference is roughly about 7° lower at our station. Two things can account for this—latitude and locality, as the close proximity of that huge mass of ice of the barrier to our station must necessarily reduce the temperatures. There is one marked similarity between the two stations, and that is the extraordinary rise of the mean for July. I account for it by the very long duration of southerly gales we experienced, during which the temperatures invariably rose to above zero. At Cape Adare, also, July was their stormiest month. In our second year, on the contrary, July was our coldest mean, and we had a comparatively calm month, the percentage of calms being the highest for the whole time we were south, namely, 34·1 per cent. In comparing the temperatures for the two years, you will notice that the second is considerably colder, and one can reason it out to some extent by the fact that there was more ice in the vicinity, and that ice was thicker than in the first year.

Whilst on the subject of temperatures, I might speak about a minimum thermometer we placed on a stand 1½ miles from the ship to the south, and well clear of all land. The difference between the readings of this thermometer and the one in the screen was extraordinary, especially in calm weather, 10°, 15°, and even 20° being a common difference. For instance, on August 10, 1902, the temperature at the screen was −35°, with light easterly airs, that at Cape Armitage being −50°. Again, on the day that we recorded our lowest temperature of −59°·5 at the screen, the corresponding minimum at Cape Armitage was −64°·6; the lowest reading at Cape Armitage was −67°·7, or nearly −100° of frost on May 16, 1903. Whether the fact of our screen being more or less surrounded by high land made that difference alone, I wouldn't like to say.

In referring to the spring journeys, I can only say that if any one seriously wants to know what real discomfort is, coupled with extreme cold, let that person go on a sledge journey, leaving the ship early in September, and I think he will agree with me that it is the acme of discomfort, and will not remain out a day longer than he can help. With regard to the barometer, I have very little to say, with the exception that, as in former expeditions, we found the pressure to be low. As a means of warning for the gales, it was not of much value, but very often showed the approach of a cold snap by falling generally. There is rather a peculiar thing that has happened to all the barometers. On comparing them with the standard at Kew, it is found that they have all increased their corrections. Whether the temperature has affected the glass or cistern to a permanent degree is not certain, but the fact remains as stated, that the corrections are all larger.

The direction of the winds is my next subject for discussion. Our prevailing wind was from an east to south-east direction. There is very little doubt but that the winds are the worst part of those regions. The question to be answered is whether the common condition down there is windy with intervening calms, or whether, on the other hand, the calm conditions prevail, broken by strong

winds. This can only be solved by the working out of the numerous observations, summmarising the whole of the work done down there; and personally I should be inclined to say that the windy condition prevails, and life made possible by the calms. Without having compared the two years' observations, I should say that our first year was infinitely more boisterous than the second; but whether or not this will be the case when the work is completed, I shouldn't like to say. I spoke earlier about the local winds, and I cannot help mentioning them again, as they were so marked, and noticed by every one on board.

Throughout the whole of our stay in winter quarters, we recorded no wind from the west or north-west, except occasional light airs. Winds from the north were more common in the summer, and especially during our last one. Gales from the south-east were generally accompanied by low temperatures, and on more than one occasion the temperatures have been below $-40°$, with a wind force of 7 to 8 blowing, making life outside the ship far from nice. But the worst gales were from the south and south-west, and we used to call them blizzards, as they were invariably accompanied by absolutely blinding drift snow. It is really a very difficult thing to any one who has not experienced a gale of this description to know what happens.

The air is entirely filled with driving snow, which strikes you just like a sand-blast. You cannot face it, but have to stumble on to wherever you may be going with your head down and arms protecting your face; and even could you face it, you are not able to see a yard all round you. I will give you an instance of how blinding they are. Whilst preparing for the winter after our arrival in the bay, and after the sea had frozen over, posts connected with ropes were led to every place where it was necessary to go every day—that is, to the magnetic huts and living hut, and to the meteorological screen.

It was during the latter part of the first winter that what might have been a serious affair happened. You may have heard that we had at times concerts, theatricals, and at one time a nigger troupe, to liven things up. Now, it was no good rehearsing these things in the ship, as every one would know exactly what was going to be done, and the jokes to be made, consequently it meant the performers going over to the living hut for the rehearsals, and as in this palace of varieties there was invariably a temperature of $-20°$ and ~~below~~ during the time we were rehearsing, it was no great pleasure playing the piano. It was on one of these occasions that I had taken the party across to the hut to rehearse the nigger troupe, and it was blowing a hard blizzard, with exceedingly low temperatures. On arrival at the hut, we found two officers, Mr. Skelton and Mr. Bernacchi, taking pendulum observations, but they left before we started our rehearsal. We finished in about an hour and a half, and then started back to the ship. As usual, one cautioned the men to keep together, and not let go the rope which led back to the ship. We had got about halfway across, the whole distance being only about 200 yards, when I heard a shout, and knew that, as it was none of my party, some one must be adrift from the ship. We opened out, and found Mr. Skelton and Mr. Bernacchi, who were quite lost, and who had been wandering about for an hour and a half, unable to find out their whereabouts. Both were more or less frost-bitten about the face, and were exceedingly glad to have been found.

One could quote many instances of the like nature, all pointing out how absolutely helpless one is in a blizzard, unless you know exactly where you are. During these blizzards the ship gets more or less buried, and everything else besides. After one or two of these, it is always necessary to lift and move the meteorological screen, as it is invariably buried. You can imagine how impossible it is to measure the snowfall under these conditions. In fact, to tell the truth, it

is always a matter of some surprise when, after the blizzard was over, one was even able to find the snow-gauge, which was completely buried under as much as 3 and 4 feet of snow.

The great peculiarity of these blizzards was the invariable rise of temperature. They always came from the south and south-west, and once the wind got back to the south-east or east the temperature always fell again. Great fluctuations in the thermograph curve always gave us some warning of an approaching blizzard. A glance at the map will show you that these south-west gales came over high land, which would cause more probably this effect, rather than the idea that they come over open water. I am unable, I am sorry to say, to speak intelligently on this subject, and will leave it to others for solution; but this I would like to say, that I have always understood that the Föhn wind is a dry wind. I may be wrong in my supposition, but our south-west winds always brought drift snow with them, and I should say that they also brought snow along with them. Our heaviest gale was on July 19, 1902, between the hours of 4 p.m. and 8 p.m. of the next day. From 10 p.m. to 10 a.m. the Robinson's anemometer gave an hourly velocity of 85 miles. By the latter part of the gale the temperature had risen to $+15°$, although it had been below $-20°$ the day before, and dropped again immediately the wind went to the east. We never got a minus maximum temperature for the month, purely by reason of these blizzards bringing the high temperatures.

To get caught in one of these gales on a sledge journey was no joke, and, speaking personally, my party was five days in a tent unable to do a thing. At another time in the same spot, Dr. Wilson was for nine days weather-bound, and, in fact, it was an uncommon thing for a party away sledging not to be laid up for one or more days. The winds experienced by the parties away sledging are very interesting. Throughout the captain's southern journey, he experienced southerly and south-westerly winds. When on the inland ice-plateau, 9000 feet above the sea-level, he recorded continuous west-south-west winds, whilst at the same time, whilst on my journey to the south-east on the barrier, we got perpetual south-west winds, and all the sastrugi—those are the snow-ridges caused by the wind—pointed to south-west, and to all appearances it is the prevailing wind. At the ship during this time they recorded continuous strong winds, but more or less from an easterly direction. Our second year's sledging season was considerably worse for sledging conditions than our first, and all the parties, on their return, complained of incessant winds, which delay a sledge-party dreadfully. It was at Cape Crozier that a party always got strong gales. Across the bay between Cape Armitage and Terror point, a strong wind was never felt; neither is there any indication of anything stronger than light airs.

I have been talking all the time about the surface currents, except in the case of the western journey, and now I will just say a word or two about the upper currents. We were very fortunate in having such a splendid indicator of the upper currents so close to us as we had in the smoke of Mount Erebus, the only pity being that it was not visible from the ship, but one had to walk out about 300 yards or so before we got it in view. Whenever any one went for a walk or was in sight of the mountain, they always, on their return, reported which way the smoke was going. The usual direction was to the north-east, pointing to an upper south-westerly current, and similar to the winds experienced by Captain Scott on the inland ice. We invariably expected wind if we saw the smoke going to the north-west, and were seldom disappointed. It was a most common thing to see the smoke going north-east at the same time you, on the level, were in a strong easterly wind, and I have noticed detached clouds, only about 2000 feet below the summit, passing quickly to the west, while the smoke was going in a steady stream to the north-east.

With regard to the precipitation, as I have remarked before, it was impossible to determine it during the blizzards. Throughout the winter months very little snow falls; but during the summer months we had very heavy falls of snow, sometimes small dry flakes, and at other times the more common English snow-flakes, damp and wet. At times there was considerable precipitation during clear weather of most beautiful ice-crystals, and whilst sledging the effects of the sun on these crystals was most dazzling. Throughout our stay inside the Antarctic circle we recorded no rain; only on one or two occasions did we get any large accumulation of fog-crystals so common on Ben Nevis. I might mention that fogs are not nearly so prevalent as is supposed, unless we were lucky in not meeting them. The amount of sunshine down there is a great deal more than we had been led to expect, and in the summer we used to get day after day of most glorious sunshine day and night.

Of other phenomena the mirage is the most common, and at times is very considerable. Haloes and coronæ are also very common, and we have seen some very beautiful and complicated effects from the former.

I trust that these few notes on our meteorology, necessarily made under disadvantages owing to our results not having yet been worked out, will be of some use. I think they may give a sufficiently clear general idea of the conditions for considering the relations between the meteorological phenomena and the physical geography of the region.

After the paper, Mr. SHAW said: The information that the meteorologists of the expedition have brought back is exceedingly interesting from many points of view. One point interests me particularly, because it confirms an idea which I had in my mind in the early summer before the expedition came back; it is the difference of the direction of the smoke of Mount Erebus from the direction of the wind at the surface. I had come to the conclusion that it was probable that the arrangement of affairs towards the south pole was a cold layer of air at the surface—about that one was sufficiently certain—and above that a layer of upper air moving independently of the lower air; and that, whereas the surface layer would probably circulate, taking the average for the year, from east to west, so that the surface wind would probably be an easterly wind, the upper air would, on the other hand, circulate in the opposite direction round the pole, so that the winds to be expected in the upper regions would be westerly winds.* One of the great good fortunes of this expedition, from a meteorological point of view, is that their winter quarters were close to Mount Erebus, and that they could see the smoke by going not further than 300 yards. It does appear that the general drift of the smoke was towards the east, whereas the wind on the surface was, generally speaking, from the east, showing a circulation in the opposite direction. That is a matter of very considerable importance to the general theory of meteorological currents. There is another point with reference to the surface winds which raises a question of interest, though I am afraid we shall be unable to solve it. It concerns the actual observed directions of the surface winds from day to day. If you consider the condition of affairs in the southern regions you will notice that they are entirely different from the condition of affairs that we have in temperate regions. I am speaking of the winter time, the most interesting time there. Here the dominant agent which causes local disturbances in the general meteorological distribution is, of course, the sun, and it is extremely powerful. There, the sun being absent, the dominant agent is the radiation to the clear sky. In our region, if the sun shines

* See *Proc. Roy. Soc.*, vol. 74, p. 28. 1904.

upon the ground it warms the air, which goes upwards and disappears; there, when the air near the surface is cooled by rapid radiation to the sky, the cold air so produced does not go away as our warm air does; it remains on the surface, and flows down like a river. The consequence is that over the whole Antarctic continent in winter you must necessarily have something that corresponds to enormous rivers of cold air flowing downwards towards the sea. How far that radiation and the consequent rivers of cold air flowing over the land affect the general meteorological conditions is again a matter of very great interest. That question, I am afraid, we shall hardly have information enough to answer. There is, besides this simple effect of radiation, the effect which the enormous height of land close to the region has in exaggerating the effects originally due to radiation. Lieut. Royds was perfectly right in assuming that a föhn wind is a dry wind. But I am not sure he is correct in assuming that, because the wind in the Antarctic carries snow, it is therefore necessarily a wet wind. Perhaps he has made experiments in that direction. Wind in those regions may carry snow with it without being necessarily a very moist wind. As a matter of fact, the amount of moisture that can be contained in air at those low temperatures is extremely small, and if a specimen of air has snow with it, it is rather a matter of curiosity to inquire where it got it from. The determination of that question would help the solution of the question whether the wind was a föhn wind. I congratulate the expedition and the Society most warmly on the contributions that they have made, and Lieut. Royds in particular for the interesting paper he has given us.

IV. THE DISTRIBUTION OF ANTARCTIC SEALS AND BIRDS.*

By Dr. EDWARD A. WILSON.

THE only mammals in the Antarctic Regions are seals and whales, and the marine life on which they live is abundant. There are, in consequence, no less than five different species of Antarctic seal, and at least as many as six different forms of whale and dolphin. Some of them occur in very considerable numbers.

Taking first the seals, the most notable point about them is that, although they form a very distinct group amongst themselves, and are distinct, *as* a group, from the seals of all the world, yet they each have a dentition which is so different from the other, that they have been considered worthy of separate generic names. The three seals which are most typically Antarctic have a very definite distribution. The first to be met with by every ship as it enters the pack-ice is the White seal, called Crab-eater—I know not why, because it never seems to eat a crab. It is the only seal that is common in the pack, and it lives there, as we know from M. Racovitza, of the *Belgica*, throughout the winter months as well as in the summer. It is met with rarely on the coast of South Victoria Land; and in McMurdo strait, whereas we saw many thousands of the Weddell seal, I do not think we saw half a dozen of the White. But in the pack-ice they are fairly common, lying out on the floes in little knots of from two to six or eight. This is the seal that appears to suffer more than any other from the attacks of Killer whales, which hunt in herds all round the edges of the ice, and leave the marks of their teeth in the skin of nearly every full-grown seal. The scars on southern seals are of two types. First, we have the long parallel rents that, as I say, are made by the teeth of the Killer whale; and these are almost invariably on the

* This and the two following papers were read at a meeting of the Research Department on February 20, 1905.

lower half of the sides and abdomen, as though the attack had been made from underneath. Then there are to be seen in the males an enormous number of shorter and smaller scars, often covering the entire body in the Weddell seal, but chiefly on the head and shoulders in the rest, and these are due to the fights that the bulls engage in amongst themselves. I have described the scars chiefly in connection with the White seal, but they are often present in the other species too.

The Ross seal is the least common of the southern seals, and we were lucky in obtaining three, while the *Morning* in her passage through the pack obtained three more. The Ross seal has been known particularly for its vocal powers, which were well described by M. Racovitza; but I think that in the Weddell we have a songster that we might pit against the Ross. This seal's power of vocalization is most remarkable, and the following is an abstract from my journal, describing an example of it: "He treated us first to the long and musical moan, which is so like the moaning of the ice, only begins high-pitched and ends up low. This was quickly followed by a series of grunts and gurgles, rather like a guinea-pig; and then began a series of plaintive piping notes, which ended up exactly on the call-note of a bullfinch, this changing to a long shrill whistle and a snort, as though he had held his breath for the exhibition much too long."

The Weddell seal is the one we saw most often, and practically lived on for a year and a half. The flesh is dark and coarse, but not always tough. The blubber alone is rank, and must be carefully dissected off the joint. The liver is most delicious. The Weddell, unlike the others, is a shore-going seal, and is seldom seen in the pack of the open sea away from land. We had large numbers of them with us all the summer, and during the winter they were only less in evidence because they lived and slept chiefly in the water. They are very slow and sluggish on the ice, but in the water as rapid as a fish.

Two seals I have not yet mentioned—the Sea-leopard and the Sea-elephant. The Sea-leopard is a great wanderer, and is known as well from Australia, New Zealand, and the Southern Ocean islands as from the Antarctic ice. He preys on the penguins, and in the stomach of one we found the skin of a well-grown Emperor. It seems he may be met with anywhere in the south, and he is not limited, as are the other three, to the ice.

The last of the seals on the Antarctic list is the one which the recent British Expedition added. The skin and the skull are at present in the hands of the taxidermist, but I think it will prove to be a wanderer from the Southern Ocean islands, representing the now rare Sea-elephant of the M'Quaries. It was a young male, about half-grown, and measured 11 feet round, and 12 feet from nose to tail.

This, then, is a very short account of the five Antarctic seals, and only three of them are strictly ice inhabitants. The Ross, the White seal, and the Weddell are true Antarctic forms; for although a stray example of the Weddell was recorded from Kerguelen island by the *Challenger* Expedition, I include him as a true Antarctic seal. I think the single occurrence of the Sea-elephant in McMurdo strait was as purely accidental as the occurrence of a Weddell in Kerguelen island.

The food that each of these seals lives on differs. The Crab-eater feeds on shrimp-like crustaceans, and his teeth are lobed to form a kind of sieve through which he squirts out water and retains his food. The Ross has finely pointed re-curved teeth, with which he holds the squids and cuttlefish that apparently form his food. The Weddell lives on shallow-water fish, and the Sea-leopard on penguins. The Sea-elephant had apparently lived on nothing when we killed him; but in the M'Quarie islands he would have lived on molluscs, which he finds among the kelp.

It is noteworthy that all these seals are what are known as earless seals, and hair seals, as opposed to eared seals, which may be fur or hair-bearing. The sea-

lions and sea-bears of the sub-Antarctic area have never been recorded from the ice. Sea-lions, which we saw in abundance at the Aucklands, are hair-seals, with a small external ear. Sea-bears—which occur also at the Aucklands, but were recently almost extinct, and are now most carefully preserved—are fur-bearing seals, with a small external ear. Both Sea-lions and Sea-bears still use their hind limbs for progression on land; but none of the Antarctic seals do this, nor have any of them an external ear, nor have they anything more like proper fur than has the horse.

The commercial value of the skins of the southern seals is very small. They make good leather, and now that hair-seals are being used for motor coats, their value may go up; but so far the Antarctic seal-fishery has never met with much success. The abundance of the Killer whale in the south must always have a depreciating effect on the value of these skins, for hardly one in eight or ten is free from the most unsightly scars. The Weddell seal, which has learned to avoid migration, and remains far south throughout the year, is the least affected by them, and as his coat is the most handsomely marked of all, it is possible he may yet be wanted by the sealers. He lives, however, in secluded bights and bays and straits, where the ice is always late in breaking up; and this, I think, would always be his main defence, for ships could not get at him till the end of the navigable season. In these secluded bays the Weddells collect in the spring, and in October and November the young are born, in a woolly coat, which they begin to throw off in fourteen days. At the end of a month it is all gone, and the young one then follows its mother into the water, and soon becomes independent.

I must not give more time now to the seals, but go on to say a word or two about the whales and dolphins.

We have very little that is new. We saw at least six different species, two or three of which have never been killed or captured, and so are without a name. One of these is a black whale of medium size, with a very high sword-shaped dorsal fin. We saw two herds of them amongst the ice in Ross sea, and Sir James Ross describes what must have been the same whale as having been seen in the same locality. There is also a very strikingly marked dolphin, which we saw round the ship on each occasion as we made our way southward through the pack. It must be a species closely allied to the Dusky dolphin, but has the rich brown and white arranged in a different manner; and whereas the Dusky dolphin is common just north of the limit of pack-ice, the species I now mention as undescribed was seen only after entering the pack. In a ship such as the *Discovery*, with so many other important interests, it was quite impossible to turn "whaler." But there is a field of work in the south in this direction which would well repay a summer cruise or two.

Sir James Ross spoke much of the Right whales he had seen in Ross sea, and what he said of their abundance led a number of whaling captains to go and look for them. But they were disappointed, for they saw not one. And much has been said since then of the possibility of a mistake having been made between the Rorquals, which are common there, and the finless Right whales, of which we saw none at all. I believe myself that the true explanation is to be found in the wasteful methods employed in Right-whale fishing in the south, where watch was kept on shore for the approach of cow-whales with their calves, and where first the calves were killed to make certain of the cows. Whaling on these lines must rapidly produce extermination. As bearing, however, on the possibility of mistake in the identification of whales at a distance, I remember once, with Lieut. Royds, watching what for a time we thought were Right whales. They were constantly appearing, evidently large whales, and with apparently no back fin, till at last we saw one separate from the rest, which came to the surface again and again, and never showed a fin till he made his final plunge, and then the hinder third of his

EMPEROR PENGUIN ROOKERY.

ADÉLIE PENGUINS.

back appeared, and showed us that he really was a Rorqual, with a dorsal fin. But I believe that whalers judge far more by the spout of a whale than by the absence or presence of a fin, and the spout of a Right whale is said to be unmistakable.

I must now leave the subject of whales, which, however full of interest, is an unprofitable one to argue from, because so little is known of them with accuracy.

In turning to the distribution of southern birds, one may first notice that some are limited to the ice, and others have a far more extensive distribution.

The Emperor and the Adélie penguins are strictly ice-birds, as are also the Snow petrel and McCormick's skua. The Antarctic petrel migrates northward in the winter, and frequents the ice within the Antarctic circle in the summer, though where it breeds is still a mystery. Then, again, the Wilson's petrel breeds in the southernmost regions, but wanders the whole world over at other times. The Giant petrel and the Southern Fulmar, Cape pigeons, certain Albatrosses, a Tern or two, and several of the Whale-birds, form yet another class which breeds in the sub-Antarctic area, and yet may constantly be seen in summer in the ice.

The whole question of the geographical distribution of the birds seen in the south is, therefore, somewhat complicated.

The Emperor penguin is the most truly Antarctic bird of all. It keeps as far as possible, not merely to the limits of ice, but to the southern border of the floating ice, or the northern edge of what is fast.

The Adélie, on the other hand, goes south to breed, but as the winter night comes on migrates to the northern edges of the pack. To the Emperor the pack-ice is a school and convalescent home, where the young are sent to change their first year's plumage, and the old ones go to moult and rest awhile from the fatigues of incubation, which, strange to say, in their case occupies the greater part of the Antarctic winter. The Snow petrel must be classed with the Adélie penguin, as it is never seen so far south as the Emperor in winter. Both the Adélie penguin, however, and the Snow petrel keep strictly to the ice, and Sir James Ross was right in looking upon the latter as an invariable sign of its proximity.

Not so the Antarctic petrel and the Fulmar, both of which are abundant in the southern oceans away from ice and out of sight of bergs in winter.

McCormick's skua we never saw away from ice, and being a shore-frequenting bird for the most part, there is a wide stretch of ocean separating him from his very close relative, the larger and darker and more northern form, the Antarctic skua. The names of these two birds are most misleading. A good deal of new light will be thrown on the distinction of these hitherto somewhat doubtful species; they will prove, I think, to be rather more distinct than they have sometimes been considered, so that their geographical distribution, as is also the case with the King and the Emperor penguins, becomes of more significance. In the case of these two penguins I remember a discussion, before the Emperor's chickens had been seen, in which it was held that the Emperor was merely a localized variety of the sub-Antarctic King. If so, the chickens would be hardly separable. But when the Emperor's chick appeared, instead of being uniformly dark and brown, he happened to be white, and so we have to consider the King and Emperor penguins as more distinct than ever.

There is a very parallel case in the two large albatrosses, known as the White-winged and the Royal. In the adults it is hard to find a difference that might not be due to age or season, but one has chicks that are always white, and the other chicks that are always brown, an apparent convergence of separate species which is a most puzzling thing.

The connection by land or glaciation of the Antarctic with the other continental masses of the southern hemisphere is a question which I must omit to touch on

here for lack of time, though it has a bearing on the seals, the penguins, and other birds that we find in the region. Judging, I must own, from the most slender indications, the Emperor penguin and the Crab-eating seal would seem to have been the earliest settlers.

The furry coat of the young Crab-eater is white, and the down of the young Emperor penguin is white. It might, perhaps, be argued from this that there was formerly more reason than there is now for protective coloration in the Antarctic, such as occurs in so many Arctic species now; and so one might argue that there was some form of predatory beast from which they had to protect themselves. But I think it is possible to show that there is a general tendency for all animals that live in the polar region, and have to face intense cold, to turn white in fur or feathers. It has been suggested that this is an economy; that it costs the bird less, or is a smaller tax on its energies, to be white than to be of any other colour. One thing, I think, is fairly certain, namely, that in the south the whiteness of animals is in no case for protection, nor is it any help to any of them in obtaining food. For example, take the pure white Snow petrel, which lives on the shrimp-like *Euphausia* that are thrown up on the ice-floes by the breaking surf. It has no enemies, and can have no difficulty in obtaining food. Or the white Giant petrel, a most interesting example, because it appears to be a species in process of formation. In the sub-Antarctic seas one may see many hundreds of black or dark Giant petrels to a single white or pale one. But once the ice is entered, the proportion of white to dark rises to something like twenty per cent., showing pretty plainly, I think, that some influence is at work to make polar species white, beside the usually accepted reasons of protection, and invisibility for getting food.

I have touched too lightly on these subjects, but my time is short, and the material has not been anything like worked out.

V. PRELIMINARY REPORT OF THE BIOLOGICAL COLLECTIONS OF THE "DISCOVERY."

By T. V. HODGSON.

VERY little can be said yet with regard to the Marine collections of the *Discovery*. At present they are all in the hands of experts for description, and at the time of collection nothing but the very briefest examination was possible. Contrary to expectation, it was found that outdoor biological work could be carried on all the year round, and that even with comfort. Holes in the ice were kept going at distances varying from 30 yards to 6 geographical miles from the ship, but in the depth of winter the limit of distance was 1½ miles. It was found impracticable at that period of the year to keep more than two holes going at the same time, and, barring accidents, their existence was limited to about three months. The collections were made in depths of from 8 to 180 fathoms. In the Ross sea, before arriving at winter quarters in McMurdo bay, a few attempts at trawling were made from the ship with varying success.

Everything goes to show that animal life is very abundant in the southern seas. Our first haul was made with a 3-foot dredge in 100 fathoms off Coulman island, and proved by far the most satisfactory. No less than sixty species were taken, and the resources of the laboratory were taxed to the utmost. Other attempts off Mount Terror and the Barrier were partial failures. In winter quarters a light dredge or a trawl was used from a whaler whenever possible, and after the

ship became frozen in, holes through the ice were cut for traps; these were assisted near the ship by a friendly crack, which enabled a line to be slipped through for a distance of 100 yards. A second line added to this enabled us to pull a light D net backwards and forwards with considerable success.

A predominant feature in the fauna was the enormous quantity of sponges, anywhere near the 20-fathom line sponges and sponge *débris* forming the bulk of the haul as a rule. Mr. Kirkpatrick informs me that this group will probably prove to contain about fifty species.

The Cœlenterata are a delicate group and fared very badly in the cold, the Medusæ and Ctenophores, which were numerous, being invariably seriously damaged by ice crystals before they could be got to the ship. Hydroids were few, though Medusæ were fairly abundant. While the sea was open a large Medusa, about 1 foot diameter, of the Chrysaora type was frequently seen but never captured. A large Periphylla was taken in two pieces from under the ice by Lieut. Shackleton. Solmundella, Phialidium, etc., were abundant, also some of the Calyconectæ, and occasionally Diphyes and Halistemma.

A very great difficulty was experienced in preserving the Ctenophores. A large Beroe was very abundant and at least three species of smaller Cydippidæ.

Two or three species of Actinians were taken and several species of Alcyonarian, including *Clavularia frankliniana* and *Umbellula Carpenteri*, (?) the latter trawled off the Barrier in 500 fathoms. Two Corals were taken in depths between 200 and 300 fathoms.

The Echinoderms were very numerous, and all hauls in shallow water less than 50 fathoms produced an Echinus, probably *Margaritaceus*, and *Cycethra verrucosa*. Fragments of *Hemiaster cavernosus* were frequently found, but only a few sound specimens. Two very fine Holothurians were dredged off Coulman island in 100 fathoms; other small ones and one or two members of the Elpidiidæ were taken off the Barrier. One or two species of Cucumaria were fairly abundant in winter quarters.

A Crinoid was found abundant everywhere just beyond the 100-fathom line. Of the Starfish a large Asterias (*A. Brandti*) was very common in winter quarters at all depths, and a single specimen of a second species was taken. Several other species were occasionally secured; one large one, about 1 foot in diameter, is closely allied to Cycethra, and another species is larger still. Ophiurids were very plentiful. *Ophiosteira antarctica* and *Ophionotus victoriæ* were not uncommon with several others.

A species of Phascolosoma was of frequent occurrence in the sponge *débris* brought up by the D net.

Nematodes are abundant in the stomachs of seals; in fact, no seal was ever seen without them. Another species was always found in the sponge *débris*.

Among the Pycnogonida, which were very numerous both in individuals as well as species, there was found a very slender form with one pair of legs more than those usually allotted to the group. This species has recently been described as *Pentanymphon antarcticum*, and beyond the extra pair of appendages does not differ essentially from the well-known genus Nymphon.

The Scottish Antarctic Expedition have found the same species at the South Orkneys, and also another, totally different, but having the additional pair of legs. This latter species was very accurately described by Eights in the *Boston Journal of Natural History*, vol. 1, 1837, under the name of *Decolopoda australis*; so that after all Pycnogonids with five pair of walking legs are nothing new. The other species may, with a few exceptions, be referred to well-known genera—Nymphon, Colossendeis, Phoxichilus, etc.

Concerning the Crustacea, this phylum, as would naturally be expected, contains a larger number of species than any other. The Decapoda are only represented by a Crangon, which appears to have a widespread distribution, and a Pandalus, both from below 100 fathoms.

Not less than fifty or sixty species of Amphipoda were taken, but with one doubtful exception these do not present any important structural peculiarities. One species occurred in great numbers, and appeared to go about in vast hordes in search of food; it was quite the usual thing to take ten to thirty thousand at a haul. Of Isopoda one very fine large species belonging to the Idotheidæ was obtained in winter quarters between 10 and 130 fathoms. What is at present supposed to be the same species was captured in large numbers by the Scottish Expedition at the South Orkneys. Three species of Arcturus were secured. Gnathia, Tanais, and the Munnidæ exist in large numbers, all of these being extracted from the sponge *débris*. One very large specimen of Gnathia was dredged off Coulman island, and a new but allied genus, quite blind, was taken as almost the only result of our one attempt at deep-sea dredging from a depth of 2030 fathoms in the pack-ice. Cymothoids were sometimes caught and occasionally seen in the stomachs of the seals killed.

In the summer a Nebalia was taken on a few occasions in considerable numbers.

As regards the crustacea of the Plankton the supply of individuals was abundant, but the number of species was proportionally small. The Schizopods occurred at times in great profusion, but not more than four or five species are expected. Only two Cumaceans were found, and those in very small numbers. Copepods were numerous and large, but in no great variety. The Ostracods were much less numerous. During the winter, hauling the tow-nets always provoked a brilliant display of an emerald green phosphorescence, chiefly from the contained Copepods and Ostracods. The large *Euphausia australis* described in the *Southern Cross* collections was met with in profusion between lats. 66° S. and 72° S., where it formed the staple food of the seals and penguins in that area.

The Polychaetes were more numerous in individuals than in species. A few species of Polynoid were abundant, and Terebellids were plentiful in the sponge roots. A Nereis was discovered commensal with an Alcyonarian. A Eunicid was taken from below 100 fathoms, and a few small species of Syllis and others were caught in the tow-net.

Sagitta was frequently obtained in small numbers, some specimens being barely an inch in length, and some were very considerably larger, probably more than 3 inches.

A very large Nemertine was taken in great abundance, and in shallow water could be seen lying on the bottom like great straps 2 or 3 feet in length, and an inch or more in width. The majority of the individuals were of a purple brown colour, but a small proportion were white. A smaller species was sometimes found among the dredge material.

Another organism gave rise to a great deal of speculation, and as a matter of convenience was regarded as a Nemertine, though suspected to be something else. It was first found entangled on Mr. Barne's sounding wire, about 80 fathoms from the bottom in a depth of 170 or thereabouts. When it arrived at the ship frozen it appeared to be close on 20 feet long, of a light brown colour, and about the diameter of an ordinary boot-lace. This organism occurred time after time on the lines, sounding and otherwise, but was always torn to shreds by the friction of the line either against the ice or the bar over which it was hauled. Two specimens were found once on the tangles in 178 fathoms, but these could not be liberated owing to the intense cold. These appeared stouter than the attenuated forms

brought up by the line. During December, 1902, a specimen was found on the tow-net line at 7 fathoms. This was liberated with care, and has been brought home, though in bad condition. In the water it appeared somewhat gelatinous, translucent, light brown in colour, though this colour was not uniformly distributed, and about a quarter of an inch in diameter. It has since been suggested that this curious organism has something to do with a Cephalopod.

The Polyzoa were extremely abundant everywhere, both in genera and species, more particularly about the 100-fathom line. On one occasion, in 178 fathoms, the trap tangles, which could not have moved over a diameter of more than 8 feet, brought up no less than sixteen species belonging to almost as many genera.

A single Brachiopod was found occasionally both in winter quarters and elsewhere below the 100-fathom line.

Concerning the Mollusca, Mr. Edgar Smith tells me the collection will prove to contain not far short of fifty species. Most of these, however, are quite small, and have been extracted from the roots of sponges and sponge *débris*. A species of Lima is very abundant there, occupying cavities just large enough for itself and lined with some fine byssus-like secretion. A fine-looking Trophon seems to be common, and a single specimen of *Neobuccinum Eatoni* was taken in 180 fathoms. Two or three specimens of a fine Chiton were captured below the 100-fathom line.

No Cephalopod was seen, but their beaks occurred constantly, though not in any great numbers, in the stomachs of the seals. A few more or less damaged shells of *Pecten Colbecki* were obtained, as well as the shells of Anatina. Numbers of empty Anatina shells could be seen lying at the bottom of the shallow water, but no living specimen of either of these two lamellibranchs was discovered.

A large quantity of a fine Cephalodiscus was taken in 100 fathoms off Coulman island, and a dead fragment was found in winter quarters at the same depth.

Ascidians cannot be said to be very numerous. One very fine specimen of the simple form was taken in winter quarters from shallow water, several individuals of a smaller species, covered all over with long bristles (?), were found in 100 fathoms, near the east end of the Barrier. Another resembling Clavellina has been taken. Only very occasionally have pelagic Salps appeared in winter quarters, but on the voyage down they were numerous.

Fishes were abundant throughout the year. The seals lived almost exclusively on them, a diet varied only with a few Cephalopods and an occasional crustacean. Notothenia and Trematomus were the genera that chiefly occurred, and several species of each genus were constantly taken in the traps. Another handsome species was taken in a well-preserved condition from the stomach of a seal, the only time it was seen. It is nearly allied to the genus Gymnodraco, if it does not actually belong to it. A very large fish, with all the characters of a Notothenia, was harpooned with a seal at No. 12 Hole. Unfortunately the hole was not enlarged to its full extent, and in dragging out the capture the fish's head was destroyed. As it was no good for a specimen it was carefully photographed, weighed, and measured. In its mangled condition it weighed 39 lbs., and its length was 3 feet 10 inches, with a girth, just behind the pectoral fins, of just over 2 feet. It formed a very good breakfast for the whole of the ship's company. No such fish was ever seen again, but skeletal remains of some approximating to the same size were found on the shore on the western side of the bay during sledge journeys.

Great numbers of small fish about 1 inch to 1½ inch were numerous in the tow-nets at all times of the year; not less than half a dozen species of these were recorded. All of these are believed to be quite young stages of larger forms.

This short note on the collections is necessarily a very superficial one, for, owing to the unexpected conditions met with, any detailed examination of the hauls was

out of the question. For one thing, the upper-deck laboratories were absolutely useless for ten months in the year, and, as a consequence, all the thawing and preservation of specimens had to be performed in an already overcrowded cabin. And for another, the discovery that outdoor biological work could be continued all through the winter involved a daily routine permitting no time for precise investigations. The capture, preservation, and storage of each day's haul proved the limit of each day's work. Taking all things into consideration, the collections cannot be regarded as large; the greater part was obtained at winter quarters in stationary traps and by using the D net, only a small proportion by trawling from the ship. What we have seen enables us to say authoritatively that the Ross sea still remains an extremely rich area for the biologist.

Mr. Howard Saunders: We have all listened with great pleasure to Dr. Wilson's interesting paper, as well as to the papers by the other officers. There are one or two questions I should like to ask. What did he find the Emperor penguins fed upon? Captain Larsen, of the *Jason*, found they had in their stomachs the remains of large cuttlefish, and of course crustacea. One or two remarks may be made about the difference in the young of the Skua gull, because the species named after Dr. McCormick, of Ross's expedition, and only recently separated from the species found to the north of the Antarctic circle, is distinctly grey when hatched, whereas the other is buffish-white. In regard to the distribution of the Emperor penguin, on the whole the evidence, so far as we could judge from the information at our disposal, was that further west, *i.e.* towards America, within the Antarctic circle the bird became more abundant than it was in Victoria Land. That is merely my impression, but I should like to hear what Dr. Wilson, who no doubt has read everything I have read and a great deal more, has to say on the subject.

Mr. Brown: I had the good fortune to accompany Mr. Bruce in his expedition to the other side of the Polar Regions. We did not winter in the far south, so I cannot say whether the Emperor penguin breeds there or not; but when we were off the Antarctic continent, we found the Emperor penguin in great numbers. But that was at the end of February, so it would not be the breeding season, and we cannot say whether they breed there. In the South Orkneys the Adélie penguins breed, and one or two sub-Antarctic penguins; we got the Giant petrel and the Cape pigeon, in addition to many sub-Antarctic birds. With regard to invertebrate fauna, I am afraid it is very difficult to say anything yet, because our collections are only now being worked out. So far as cuttlefish are concerned, we found a great many beaks in the stomachs of seals. They were extraordinarily common, and we found, I think, three species in the South Orkneys. The invertebrate fauna there was very rich in schizopods and echinoderms generally, as Mr. Hodgson stated. With regard to the food of the Weddell seal, we found a great many beaks of cuttle-fish in their stomachs, and we also found remains of holothurians. The Sea-leopard occasionally came south of the Orkneys, but we did not find that it bred there; it is the Weddell seal that breeds there, and in very great numbers. We only got a single specimen of the Ross seal there, and I think we only saw two others in addition to them.

Dr. Edward A. Wilson: With reference to the food of the Emperor and the Adélie penguins, I have not much to add to the list. Cuttlefish beaks are frequently found in the stomachs of both, but fish seem to form the principal diet of the Emperor, whereas crustaceans are the staple diet of the Adélie penguin. Stones you always find in the penguins' stomachs. Even the stomach of the youthful chick which had apparently only just come out of the egg, was already filled with stones. I think they find they can work down the bones of the fish

and the shells of the amphipods that they eat better if they have stones in their stomachs than if they have not.

As to the distribution of the Emperor, the *Belgica* saw large numbers in the pack-ice to the west of Louis Philippe Land, but I believe the largest numbers of all were what we saw in what has been called King Edward VII. Land, a place we were unable to land on because the ship was getting frozen in. As to the breeding-place of the Brown-backed petrel, Lieut. Mulock mentioned there were thousands of birds on Scott island, and I think that is the place to go with the greatest probability of finding its eggs. We saw no place which was likely to produce Brown-backed petrels' eggs.

Captain SCOTT: I think the pack ice we saw contained a great deal of old ice mixed with one year ice.

The PRESIDENT: The meeting will wish to pass a vote of thanks to Dr. Wilson for his very interesting paper, and to Mr. Hodgson for his account of the invertebrate fauna; also to Captain Colbeck for his excellent description of the pack in various meridians and in various seasons. We also have to thank Lieut. Mulock for having read the paper so well and described to us the illustrations. I may add that he himself very carefully surveyed Scott island, and that we shall thereby be indebted to him for a most accurate and valuable map of the Antarctic discoveries. I now ask you to pass votes of thanks to these gentlemen for their papers.

OBSERVATIONS ON THE ANTARCTIC SEA-ICE.*

By Captain W. COLBECK, R.N.R.

FOR the following remarks on the southern ice-pack, I have drawn on my diaries for three seasons—1898–1900, when magnetic observer of the *Southern Cross*, and 1902–1904, when in command of the *Morning* Relief Expedition. The northern limit of the pack varies according to the meridian on which it is approached, and also according to the severity of the season, as will be seen from the following summary of the three voyages southward.

On December 30, 1898, the *Southern Cross* fell in with small drift-ice in lat. 61° 56′ S., and long. 158° 53′ E., and a few hours afterwards entered the main pack. For 70 or 80 miles we steamed through small floes without much difficulty, and were then faced by much heavier and more closely packed ice, varying from 4 to 10 feet thick, in immense floes. An attempt was made to force our way through between the 160th and 166th meridian which proved futile, the ice as we worked southward becoming heavier and the floes of greater area. From January 12 to February 10 we were within 80 miles of the Balleny islands, hemmed in on all sides by heavy ice; during this time, we took advantage of every opening to the south and east, changing our position a few miles daily, but making no material progress southward. The ice in this vicinity varied considerably; at one time we would be beset between floes 4 or 5 miles square and from 4 to 6 feet thick, with no open water visible in any direction. After a few hours light southerly or south-easterly wind and a day's steaming in the open leads, we would find smaller and heavier floes, such as our Norwegian whalers called "blue" ice, 10 to 20 feet thick, with numbers of much-worn bergs within a few miles of us, at another time the floes would be smaller and honeycombed, some of them half a mile to a mile in extent, upon which it was impossible to travel except upon ski, and even then it frequently happened that the upper surface would give way and we

* Read by Lieut. Mulock.

would find a footing on a honeycombed platform about 2 feet below. During January and the early days of February we experienced several heavy gales from west-south-west, north-east, and east-south-east; with the northerly gales a heavy swell was at times noticeable, but it had no effect on the floes around us; with the easterly and westerly gales there was no swell, nor was there any appreciable change in the ice-conditions afterwards. We experienced a strong westerly drift when to the eastward of the Balleny islands. The most favourable conditions for navigating were met with after light southerly winds or calm.

On February 7 we turned northwards, and after passing through heavy ice for forty-eight hours, fell in with loose sailing pack, in the same position where fourteen days earlier we had been faced by very extensive and closely packed floes from 4 to 6 feet thick. This was in lat. 65½° S., and long. 165½° E. Thence we steered an easterly course through loose ice, as far as 174° E. and 65° 40′ S., where open water was met with and a southerly course taken. Between lats. 68° and 69° S. we encountered a belt of pack about 30 miles broad, running east and west; but after passing through this only loose ice was seen, and we arrived at Cape Adare on February 17, 1899.

After the difficulties we had experienced to the westward in the *Southern Cross*, I had no hesitation in choosing a more easterly meridian on which to approach the pack, and decided to work southwards between longs. 175° E. and 180° E. in the relief ship *Morning*.

After leaving New Zealand on December 6, 1902, a course was set to cross the 60th parallel in long. 175° E., and thence due south to the pack; but in consequence of adverse winds being encountered, a more easterly course had to be taken. We saw our first iceberg in lat. 62° 5′ S., and fell in with loose pack and drift-ice in lat. 67° 40′, long. 179½° E. We entered the main pack in this locality, and made about 100 miles to the south-west through loose hummocky ice before our difficulties really began. Up to this time we had been passing through belts of pack about 2 to 3 miles broad, running in a north-westerly and south-easterly direction with a mile or two of open water between them.

On reaching lat. 69° S., long. 175° E., the pack became closer, and we fell in with a number of ice islands, irregular in shape and quite distinct from the tabular berg common to these waters; they were visible so far as we could see to the eastward, and in the pack in their vicinity some very heavy old ice was observed with evidence of severe pressure during a previous season. We worked south from this position, averaging from 20 to 30 miles a day through loose but heavy pack; the smaller floes of 2 and 3 feet ice which were observed between the larger and heavier floes showed signs of recent screwing. We again met with close pack in lat. 70° S., through which we could make but little progress. When in lat. 70° 26′ S., and long. 175¼° E., we encountered a heavy east-south-east gale, which drove us into open water in long. 170½° E., apparently extending to the coast north of Smith inlet. On the gale abating, a course was set for the coast; but the heavy floes and small bergs, closely packed along the coast and to the northward, prevented our approaching within 40 miles of it. We worked in a line of open water, between the coast pack and the loose ice to the eastward, until within a few miles of Cape Adare, where we fell in with loose ice; this, however, did not retard our passage, and we landed at Cape Adare on January 8. The ice in Robertson bay had only broken up in the vicinity of the cape, and there was every indication of its being a very late season.

On leaving Cape Adare we followed the coast-line, keeping well inshore to avoid the pack which showed up to the eastward. South of Possession island the ice was very heavy and closely packed. Coulman island was surrounded by

SCOTT ISLAND AND HAGGITT'S PILLAR.

BEACH ON SOUTH-EAST SIDE OF SCOTT ISLAND.

immense fields of ice, and in the direction of Wood bay there was one solid field unbroken as far as the eye could see. A landing was effected at Franklin Island after great difficulty, the approach between unbroken floes of flat ice, 2 to 4 feet thick and several miles in length, being very tedious. From Franklin island we stood away to the north-eastward into open water, and then skirted the pack to Cape Crozier. The run from Crozier to McMurdo bay was through very heavy and close pack, and our success in making the passage as we did between Cape Bird and Beaufort island was mainly owing to the strong westerly drift on the northern shore of Ross island. After clearing Cape Bird we fell in with open water until faced by the field-ice extending to the *Discovery's* winter quarters.

The following year, we left Hobart on December 6 in company with the *Terra Nova*, we fell in with our first iceberg in lat. 62⅓° S., long. 177° E., and entered the pack on December 26, in lat. 66½° S., and long. 179¼° W. The ice on the outer edge was apparently old ice about 10 feet thick, and quantities of screw and hummocky ice were observed. After passing through about 60 miles of very heavy and closely packed ice, we were able to make a good course southward through loose and open pack until in lat. 69½° S., when we encountered a fresh gale which closed up all the leads—we were compelled to lay to for thirty hours in lat. 69° 22′ S., and long. 178° 37¾′ E. On the weather moderating, the ice opened up, and we had no further difficulty in making our course good, passing through the outer edge of the pack in lat. 70° 20′ S., and long. 176° 53′ E.

We found the Ross Sea quite open, and although we crossed our last year's track several times, no ice was met with, and we were able to traverse the same distance in four days which had taken us twenty-two days to do in the previous year. Off Beaufort island we passed through a belt of loose ice, about 30 miles broad, and arrived at the edge of the field of ice in McMurdo bay on January 5.

From the experiences, as related in the foregoing, I have no hesitation in saying that the pack should be entered between long. 178° and 180° E., as early in December as possible, and so take advantage of the whole of the open season. The ice between these meridians being lighter, more open, and easier to negotiate than to the westward, and moreover having no extent of land nearer than the Balleny islands, there is very little danger of the ship being damaged by pressure.

In the event of a ship going south for geographical work during the summer, I would strongly recommend that a due easterly course be taken after reaching the latitude of Cape Adare, with the view of examining the east side of the Ross Sea. The ice islands and the nature of the drift-ice we met with during our first cruise in the *Morning* gave every indication of having broken away from a glaciated coast-line in that locality.

The difficulty experienced by the *Southern Cross* when attempting to force our way through the pack in the vicinity of the Balleny islands was, no doubt, due to the prevalence of easterly gales in the Ross Sea, and the westerly drift north of Victoria Land, both of which tend to drive the pack in that direction, where it is held up by the islands until late in the season, and does not disperse until the sea to the westward is free from ice. We found no uniformity of thickness when in the pack, the nature of the ice varying from hour to hour.

I consider that the middle and the southern edge of the pack are the most difficult to navigate. At the northern edge loose drift and water-worn ice was met with for several miles before the pack was actually reached; and in the case of the *Southern Cross*, and the first voyage of the *Morning*, we sailed through from 80 to 100 miles of loose ice before meeting the close pack. On our second voyage in the *Morning*, however, when only a few miles from the northern edge, we were faced by as close and heavy pack as any we encountered during the voyage. In the

first year we had no southern limit, the pack extending practically to Cape Crozier. On the second voyage we were more fortunate, and, after passing through 30 miles of very loose sailing pack, we got into open water to the south, in lat. 70° 22′, leaving a clearly defined line of pack behind us.

Our first season, 1902–1903, I consider to have been exceptionally late and severe, and am of opinion that the conditions we met with in 1903 and 1904 were normal, and were such as might reasonably be expected by any one navigating in these regions. This conclusion is arrived at by comparing the ice conditions we met with during the *Morning's* two voyages with those observed around Cape Adare during my winter there in 1899.

A strong northerly current exists on the coast of Victoria Land, and is in a great measure responsible for the rapidity with which the ice clears away during the open season. It was an agreeable surprise to me to find so much open water on my return voyage in March, 1903; I did not think it possible that such a great change could take place in six w eks. Our only difficulty was when passing between Beaufort island and the Western mountains, where we were stopped by young ice from 4 to 8 inches thick, extending to the horizon on all sides. We were, however, favoured by a south-westerly gale, and managed to work through it under sail and steam, meeting with pancake ice as far as Coulman island. The coast-line was fringed with pack, but no ice was visible to the eastward.

On the return voyage in 1904 no new ice was observed, and with the exception of a small belt of pack south-west of Coulman island, the passage was made in open water. That there is a westerly drift on the north coast of Ross island was proved during our first voyage; we had further evidence of this when lying in McMurdo bay, and also that the current turned northwards along the coast of Victoria Land. I am of opinion that this current takes a north-westerly course after passing Cape Adare, and that it is the ice from further south, piled up on the coast, which has so far prevented an examination of that part north of Robertson bay.

On December 25 we sighted two small islands, bearing south-south-east, about 25 miles distant. We took a sounding when about 5 miles north-north-west of them, and got no bottom at 1000 fathoms. The larger island is about ¼ mile long and ⅛ mile broad, lying in a N. by E. and S. by W. true direction, the northern end being about 126 feet high, and "steep to." The southern end was lower, and partially covered with an ice-cap sloping from the northern end, and appearing to get much thicker where it discharged into the sea. The northern extremity was almost bare of snow, much weathered and water-worn at the base of the cliffs. In each of the northern points there was an arched rock, the larger of which was about 80 feet high and 50 feet broad. The smaller island, which was almost circular, was about 200 feet in diameter, to a height of about 185 feet, with a conical top (the summit of which was about 209 feet above the sea-level), and was situated nearly a cable's length to the north-north-west of the larger island.

Whilst pulling round the larger island we noticed two beaches—one on the west-by-north, and the other on the north-north-east side. The first we estimated at 80 feet long, and the latter 50 feet, both shelving very rapidly, and making it impossible for us to land. The W. by N. beach sloped more gradually, but the approach was equally dangerous, owing to a number of rocks partially covered by the sea, lying about 100 feet from the beach. We managed to effect a landing on the southern part of the island by backing the boat in and jumping on a low rocky ledge as we rose to the swell. Having collected specimens of rock near our landing place, we returned to the boat, and pulled round to the smaller island. There was now no snow on the latter, which looked like basaltic rock as far as the cone, which had a reddish brown appearance. About a third of the way up

LOOSE PACK, NORTHERN EDGE SHOWING LINE OF OPEN WATER.

FLOES BREAKING AWAY FROM THE FIELD-ICE IN MCMURDO BAY.

the cone there was a thin stratum of grey-coloured stone, which appeared to separate the black basaltic rock from the reddish formation above.

Thousands of birds—Wilson's, brown-backed, and white petrels, prions, and cape pigeons—were seen near these islands, the northern end of the larger and the cone of the smaller one being covered with them.

On the following day we had fine clear weather. Good observations for latitude and longitude were obtained, and Lieut. Mulock made a sketch-survey, and took soundings all round the islands. The position of the centre of Scott island is lat. 67° 24½′ S., long. 179° 55½′ E.

THE GREAT ZIMBABWE AND OTHER ANCIENT RUINS IN RHODESIA.*

By RICHARD N. HALL.

Progress of Researches.—Before introducing a discussion as to the recent researches respecting Rhodesian antiquities, I would venture to express my high appreciation of the work of the late Mr. Theodore Bent at the Great Zimbabwe. Having devoted eight years to the study of the ancient monuments in various parts of Southern Rhodesia, and having resided for over two years at Great Zimbabwe, I have no hesitation in stating that I have found Mr. Bent's work to be both valuable and reliable. Mr. Bent experienced great obstacles in his examination of these ruins. He found the ruins to a great extent buried in soil and *débris*, and covered with dense and almost impenetrable jungle. He was also seriously handicapped by the shortness of his stay, by an insufficiency of labourers, and by adverse climatic conditions; yet he was able to sweep away many of the myths, romances, and theories which had always surrounded the Rhodesian remains. But to Mr. Bent belongs the credit of giving to this problem an entirely new orientation. This new orientation is now unreservedly recognized in the highest scientific circles of Europe as practically incontestable.

The recent researches have yielded additional internal evidences in support of Mr. Bent's conclusions, that the oldest portions of the Great Zimbabwe, and a certain number of the ruined structures elsewhere, testify to Southern Rhodesia having once been a colony of the ancient empire of Saba, in South Arabia.

The Royal Geographical Society was primarily responsible for the visit of Mr. Bent to Rhodesia. This Society, by its practical assistance and its consistent interest in our ruins, has always acted *in loco parentis* to researches in Rhodesia. In a sense, the Rhodesian monuments may well be considered as one of the specialities of the Royal Geographical Society. All South Africans will, with confidence, continue to look to the Royal Geographical Society for further manifestation of its support and interest in this direction.

* Read at the Royal Geographical Society, January 23, 1905.

Not a single one of the hundreds of ruins in Rhodesia can be said to have been more than partially explored. Many ruins of major importance, some rivalling in certain respects the Great Zimbabwe, have never been seen save by casual travellers, while it still requires more than the labour of a lifetime to unearth but a portion of the Great Zimbabwe area. Dr. Petrie informs me that his difficulty in Egypt is not that of means, but of obtaining sites to explore. In Rhodesia we have the sites, but do not possess the means. Research in Rhodesia has always been by unassisted individual effort, and hence it has been spasmodic and without organized system.

Sir William Milton, the Administrator of Rhodesia, has shown in a practical form his deep interest in the preservation of the ruins of Great Zimbabwe. He is entitled to your warmest thanks for taking timely action to secure their preservation. But every pioneer bemoans the preventable dilapidation at many of the most important ruins throughout the country. Whole lengths of high walls are disappearing. These prehistoric buildings can never be replaced. This is a matter of grave concern for archæologists everywhere, and one that demands prompt attention.

Since Mr. Bent published 'The Ruined Cities of Mashonaland' in 1892, decided progress has been made, both at Great Zimbabwe and elsewhere, in the investigation of our ancient monuments. The last three years have witnessed the following advance in these researches:—

(1) The re-examination of Great Zimbabwe, including the unearthing of floors, passages, drains, and walls, with a detailed description, accompanied by plans, sections, and photographs, of all architectural features, methods of construction of the ruins of several ages in this group, thus constituting a permanent record of Zimbabwe which must prove of incalculable value in the discussion of these ruins.

(2) The re-examination, in the light of discoveries at Zimbabwe, of ruins elsewhere in Rhodesia which had previously been located and described.

(3) The discovery and examination of numerous and altogether fresh ruins of both major and minor importance, the existence of which was unsuspected, the reports on these ruins including plans, photographs, and detailed descriptions.

(4) My recent inspection, on behalf of Mr. Rhodes' trustees, of the ruins of the Inyanga area, including (*a*) hill terraces, (*b*) hill forts, (*c*) aqueducts, and (*d*) so-called "slave-pits," the reports on these ruins and on the relics containing plans and photographs.

(5) The comparisons, by means of photographs and written descriptions, of the ruins of Mount Injakafura district with those at Zimbabwe and elsewhere in Rhodesia.

(6) The plans carefully prepared by Mr. Franklin White of certain

ruins in Matabeleland, and also his recent survey of the elliptical temple since the explorations.

(7) The inspection and reports on some scores of stone-built villages, and stone rampart forts on hills, of the Makalanga and Barotse.

(8) The successful tracing of several additional chains of forts in several parts of the country, especially in the Motelekwe and Sabi districts.

(9) The securing of the exact locations within numerous ruins of some two hundred relics and "finds," with particulars of their associated articles, their locations on certain floors, and the associated features of architecture and construction of the buildings in which they were found,

VIEW OF INTERIOR OF ELLIPTICAL TEMPLE FROM SUMMIT OF NORTH WALL.

these buildings being of several distinct types of architecture, each yielding distinct classes of relics, both buildings and relics representing periods extending from pre-historic times to within, in some instances, but a few score years ago.

(10) The accumulation of a vast fund of expert opinion as to the relative ages and the origins of the relics and "finds," and their parallels and identities in other lands.

But while these and other internal evidences have been obtained from the actual ruins, other researches have, within the last few years, been prosecuted in various quarters, from which much additional light has been, and may yet further be, shed on the origin of the Rhodesian monuments. Some of these may briefly be stated as follows :—

(1) The very marked advance within the last few years in archæological researches in Arabia and the Near East, and further examination of historical records concerning the peoples who are now believed to have been responsible for the oldest type of building in Rhodesia. It is now possible to speak with fuller knowledge and greater assurance of such matters, which before were largely subjects of conjecture only.

(2) These remarks apply also to recent researches with regard to the close connection existing in mediæval times between Arabia, the Mozambique coasts, and Rhodesia.

(3) The recent discoveries by M. Grandidier and other savants of the traces of the influence of Sabæans, Phœnicians, and Idumean Jews of the Red sea on the Mozambique coasts and Madagascar.

(4) A fuller knowledge of the extent and methods of ancient gold-mining in Rhodesia, as apart from gold-mining in these regions by mediæval Arabs and Portuguese, and also by indigenous people. The confirmation of the suggestions made by the late Mr. Telford Edwards as to widely distinct mining operations at totally different periods and by different peoples.

(5) The study now in hand of such of the trees and plants found in the ancient mines and ruins' area as are not indigenous to South-East Africa.

And (6) a largely increased fund of information as to the history of the once partially civilized Makalanga, or "People of the Sun"—both of Matabeleland and Mashonaland—from the earliest mediæval times to the present day, and the preparation by Dr. John Helm and the Rev. A. A. Louw of the first grammar of the Chicaranga language.

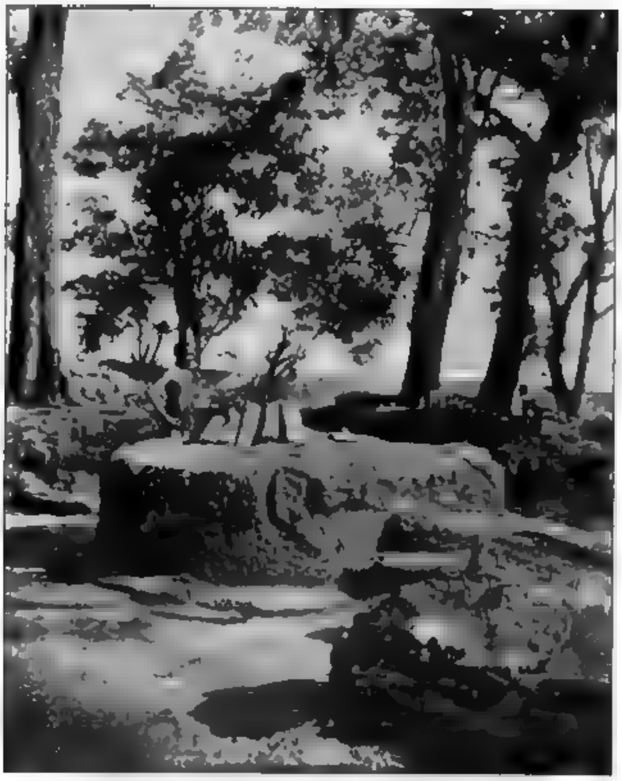
It will thus be seen that within the last few years archæological and antiquarian researches in Rhodesia have made very great progress, and the results so obtained, added to our previous knowledge, enable us at last to pronounce some judgment on certain of the distinct types of ruins to be found in this country.

Variety of Ruins.—It may be taken as a very modest estimate that there have been located in Rhodesia no less than three hundred distinct ruins and groups of ruins, and these, or such of them as were first discovered, were classed by all writers as "ancient," this term having also been applied to many of such ruins as are of mediæval and even of later times.

Probably it would be more correct to say that the term "ancient," as relating to the suggested Sabæan occupation of Rhodesia, can only be applied to a few scores of the three hundred of Rhodesian buildings, though later investigations may show that certain other ruins are also entitled to rank under the title of "ancient" as so understood. Of this older class of ruins, the oldest portions of the elliptical temple and of the Acropolis ruins, and probably certain walls in the Valley of Ruins, may safely be considered to represent the most ancient form of architecture extant in Rhodesia.

But there are many ruins showing distinct forms of architecture and construction hitherto termed "ancient," and once considered to be such, which can now be shown to be ancient in a modified sense only—that is, though they bear evidence of some antiquity, the manner of their construction and the nature of the relics yielded on their original floors, point to a period much later than any Sabæan period.

There exists a further type or class of ruins of certain well-defined



GRANITE-CEMENT PLATFORM AND STEPS, AND CARVED SOAPSTONE BEAMS, NORTH OF COUNCIL TOWER, DISCOVERED 1903.

style of architecture and construction which give evidence of erection at a still later date, and these yield no relic which, in the opinion of the highest expert authorities, can date back beyond the thirteenth, fourteenth, or fifteenth centuries of this era. To these two latter classes, I believe that the bulk of the ruins in Rhodesia belong.

Again, ruins exist, also hitherto styled "ancient," which have clearly been the work of some comparatively later indigenous people, the construction of which does not suggest any controlling influence of a foreign race. These appear to have been a crude reproduction by natives of

the older and much superior buildings in the country. In this class of poorer construction, nothing save distinctly native articles are to be found. Some of these structures are doubtless several centuries old, but others are of later date.

In 'The Ancient Ruins of Rhodesia' the authors defined two principal classes and ages of ruins to be found in Rhodesia, and these were respectively called First and Second Period buildings. From the descriptions of these distinctive styles of architecture therein set forth, I have, after three years' additional exploration work in several types of ruins, nothing or hardly anything to withdraw, but, on the other hand, very much more information to strengthen the argument, which can now be carried much further, even beyond the reach of controversy.

It is from a consideration of the type of first period ruins alone that authorities can demonstrate that the architecture of the oldest ruins was not evolved and did not originate in Rhodesia, but was directly imported from the Near East.

Evidences of Ancient Civilization.—It can fairly be asked, What evidences exist of ancient civilization and arts on the part of the builders and occupiers of the ruins of the earliest period? These are not far to seek. Looking at the Great Zimbabwe, we find them to be abundant. There is overwhelming proof in this direction in the actual walls, in the relics discovered on the lowest floors, and in the "finds" of gold of the early period, and in the character of a religion which constrained the ancients to devote such an immense amount of patient labour and such marvellous constructive skill in the plan, erection, and decoration of their temple. The Zimbabwe temple is now admitted on all hands to be the finest and most intact example of a Nature-worshipping shrine known to the world.

The mural decoration of chevron pattern, the monoliths, and also the remains of small towers on the summit of the east wall immediately over the pattern, the great tower of conical form, the platform, and the general plan of the structure, all point unmistakably to some knowledge of geometry and astronomy on the part of the builders. The application of these sciences for Nature-worshipping purposes was common to the ancient Semitic peoples, whether of Babylonia—the cradle of the zodiacal science—Phœnicia, Arabia, and elsewhere. The astronomical knowledge of the Semitic race was profound.

But whether the ancients of Zimbabwe carried out the principles of these sciences to their full extent is a matter which for the present is *sub judice*. At any rate, it is obvious that some of these principles were applied at Zimbabwe and at some other ruins, and that the ancients by these means marked off the seasons and periods of the year, and so provided the elements of a calendar, fixed the times of agriculture, and marked the festivals held in honour of natural powers. Knowledge of even the elements of such sciences could not

be otherwise treated than as pertaining to people who were largely civilized. Whatever the degree of knowledge of these sciences possessed by the architects of Zimbabwe and other ruins may have been, it is quite a moral certainty that even the cruder methods of their application were imported from the Near East, and did not originate in South-East Africa.

But there is not lacking authoritative opinion that the application of such sciences to the buildings of Zimbabwe enabled the solar and

CHEVRON PATTERN EAST MAIN WALL, ELLIPTICAL TEMPLE.

astral worshippers to observe the planets and stars, but most probably those of the northern hemisphere. The right ascension of the sun, the heliacal rising and the meridian passages of stars are believed to have been noted at Zimbabwe. Solar and astral worship as evidenced at Zimbabwe must have been coeval with an advanced form of civilization.

The older walls of the temple to no less extent envisage the fact of a high state of skill in architecture on the part of the builders.

One has but to glance at the grandly sweeping and massive walls for convincing proof on this point. The architectural features declare loudly the skill and art of the ancient builders. The even courses, the carefully selected blocks, the beautifully worked out batter or lean-back faces of the walls, so free from defects of construction, the elaborate system of drainage contemplated when the first foundation stones were laid, bespeak an art which baffles and amazes all practical builders of to-day. Such a monument of architectural and constructive skill as these grey walls present does not testify of an uncivilized race.

But the ancient builders were past masters in the science of military defence. Traverses, buttresses, screen-walls, intricate entrances, narrow and labyrinthine passages, sunken thoroughfares, rampart walls, banquettes, parapets, sentry recesses, and all other devices of a people thoroughly conversant with military engineering and defence, are the prevailing features of all first period buildings throughout the country. These, in their ingenuity, massive character, and persistent repetition at every point of vantage, astonish the best experts of modern military engineering science. The ancient builders were military strategists of the highest order. Such a demonstration in this direction do these stupendous walls afford that one's mind is forced to the only possible conclusion that their constructors must have been a civilized race.

The ancient gold found so plentifully on the lowest floors afford similar testimony to the skill of these ancients. Gold ornaments of most excellent make, and so pronounced by jewellers at Home, could not have been the work of an uncivilized people. Engravings on some of the ornaments, so minute and delicate that nineteen out of twenty persons examining them would not detect the presence of decoration, bespeak artistic skill and workmanship of highest order. Tacks of gold so microscopic in size that without the aid of a magnifying glass it is often impossible to say which is the point and which the head. Work which, one would suppose, must have caused the ancient goldsmith to go blind at an early age is inconsistent with the idea of a lack of civilization. Their extensive smelting of gold and the employment of fluxes, now analyzed, might also be cited as additional evidence to the same conclusion.

The carvings of beautifully symmetrical and massive soapstone bowls and their decorations, also the carved soapstone beams, and similar articles, tell of a sculptor's art which was by no means crude.

But one turns to their gold-mining operations and sees written large in reefs that these ancients possessed a wonderful knowledge of mineralogy. The many hundreds of ancient gold-mines scattered thickly over the whole country lying between the Zambezi and Limpopo rivers yield evidences of the ancients' skill in metallurgy. They picked out rich shoots, patches, and pockets with marvellous cleverness. They knew the assay value of the quartz they worked. They differen-

tiated the worth of "footwall" or "hanging wall" as the case might be. The sinking of shafts, the driving of long adits, the avoidance of the more refractory ores, testify to their skill as miners.

Taking all these evidences into consideration, and knowing that these ancients extracted some seventy-five millions of pounds sterling worth of gold—and this is a very reasonable estimate—it is impossible to conceive any other people than those experiencing the advantages of civilization, and of extensive knowledge of mining in other countries,

PATTERN PASSAGE, ACROPOLIS, LOOKING EAST.

to have carried on these operations, which were conducted on such inconceivably extensive lines.

The argument could be developed much further. For instance, the arrangement and distribution of the ruins of the first period throughout the whole country, whether as capital centres, or in districts, or in chains protecting routes at strategic points, reveal an admirable system of organization having once been in existence, an organization

by some superior race possessing an intelligence which is simply marvellous.

The lecturer, by means of plans and sections of four distinct ruins, showed the methods adopted by the ancients for fixing times and seasons; and later, by means of a large number of magnificent photographic views thrown on the screen, conducted the audience on a tour of the Great Zimbabwe ruins, pointing out features of ancient architecture, and explaining many matters of great interest, including the numerous prehistoric relics discovered by him during his recent explorations at these important ruins.

Before the paper, the PRESIDENT said: It is now upwards of fifteen years ago since our lost friend Theodore Bent read us a paper on the interesting subject which will occupy us this evening. I have great pleasure in introducing Mr. Hall to the meeting, who has devoted many years to these researches, and will give us, I am sure, a most interesting account of them. I will now call on Mr. Hall to read his paper on "The Great Zimbabwe and other Ancient Ruins in Rhodesia."

After the paper, the PRESIDENT said: I am afraid it is too late in the evening for us to enter into a discussion, but I am sure it has been a great satisfaction to all of us to hear from Mr. Hall how accurate and how useful have been the labours of our old friend Theodore Bent. Of course, as we have seen and heard to-day, Mr. Hall has done much more, having been many more years at work, and I think what has struck me most, and probably has struck the meeting, is how history may be written without any books. By a careful and accomplished investigator, like Mr. Hall, we are informed simply by the studies of these ruins how in most ancient times a colony from Asia established itself in the centre of Africa, and how a great oceanic trade was continued for several centuries. We have been able from these ruins to learn the method of building of these colonists, their style of art and of ornamentation, their system of drainage, their system of constructing aqueducts, the character of their religious rites, and even the age in which they were established, the chronology, and the fact that they departed suddenly—all this we learn, not from any books, but from the studies of ruins by an able man like Mr. Hall. You will all wish to pass a very cordial vote of thanks to him for the way in which he has explained to us the history and the story of these ruins by his illustrations and by his very lucid account of them. I have much pleasure in proposing a hearty vote of thanks to Mr. Hall for his interesting paper.

EXPLORATION OF WESTERN TIBET AND RUDOK.*

UNDERTAKEN BY CAPTAIN RAWLING AND LIEUT. HARGREAVES, OF THE SOMERSET LIGHT INFANTRY, IN 1903.

By Captain C. G. RAWLING.

THE expedition into Western Tibet, undertaken by Lieut. Hargreaves and myself during the summer of 1903, had for its chief object the extension of Captain Deasy's survey made in that direction in 1896.

Every assistance was given us by Colonel St. G. Gore, Surveyor-

* Map, p. 480.

General of India, including the loan of all necessary instruments. A sub-surveyer, Ram Singh by name, was also lent to the expedition, and proved himself a clever and painstaking draughtsman.

Leh, the chief town of Ladak, formed the base from which the expedition set out, and here the caravan men were engaged, and the ponies, to the number of forty-three, bought. Over sixty yak were hired from the town of Tankse, for the purpose of carrying grain for the ponies. The expedition consisted of Lieut. Hargreaves and myself; Babu Ram Singh, sub-surveyor; Abdal Khalik, the caravan bashi (a well-known man who had been formerly employed by Captains Bower and Deasy); four Kashmiris, six Argoons, and seven Ladakis.

On June 3 the expedition left Phobiang, the most easterly inhabited spot in Kashmir territory, following the usual route taken by former travellers, over the Marsi-mik La into the Changchenmo valley, and from there over the Lanak La into Tibet. From the eastern side of the pass we descended into the Sumjiling plain, which Captains Bower, Deasy, and Wellby had also traversed, and marched along it in an easterly direction to the large fresh-water lake of Arport Tso. This part of the route is already well known.

The hired yak, being slow movers, were directed to follow us to this lake, and here Lieut. Hargreaves remained some days, in order to bring on the expected grain.

In the mean time I set out in a south-easterly direction on a route lying at first to the south, and then to the north, of that taken by Captain Bower in 1890. I then turned due north, and struck into Captain Deasy's track at Antelope plain, the furthest point east reached by him. Here Lieut. Hargreaves and I had arranged to meet, but on the second day after reaching the place, messengers arrived from him with the information that twenty out of twenty-five of his ponies had been killed by a blizzard, which had raged for four days. They also stated that he had attempted to reach our pre-arranged meeting-place, but that at Yeshil Kul the five remaining animals had broken down, and that he was now encamped at that lake, unable to move backwards or forwards.

On hearing this news I hastened to join him, travelling by the route which Deasy had followed, and found him encamped on the shores of this lake. The reason for his being left in this plight proved to be that the hired yak-drivers, whom we had trusted to follow us, had thrown away their loads of grain, and had deserted with their yak, not one having arrived at Arport Tso as agreed upon.

Previous to this meeting, however, my party had explored a district unknown to the European. After moving south for 4 miles along the western shore of Arport Tso, the road led up a narrow arm of the plain into the heart of the Arport Tso mountains. These mountains are conspicuous by reason of the contrast of colour; they resemble piles

of coal-black stones, and are covered by a field of snow, from which glaciers pour down each valley, the contrast being very conspicuous and picturesque.

A moderately easy gradient leads up to the Lungnak La, 18,650 feet. On the summit of this pass, extending for a distance of 3 miles, is a level stretch, the soil of which is composed of partly disintegrated granite, and infiltrated with water. The descent on the far side is easy, and leads into an immense plain lying north and south. Crossing this plain from west to east, one short march further on, the road turns south to the shores of Shemen Tso. This lake, which is over 100 square miles in extent, is bitterly salt, and in shape very irregular, with numerous rocky promontories running into it from east and west. At some former date it evidently occupied a much greater area. The shores slope gradually, and are covered with grass. The northern shores and neighbouring valleys are frequented by enormous numbers of wild yak, antelope, gazelle, and kiang. To the east and south the hills are of a light colour and barren, while to the north and west they are dark and fertile. But one stream runs into the lake, and that from the east. About half a mile from the shores of the lake, at a spot where the camp was pitched, an area of about 5 acres in extent was covered with ice, over which lay a thick layer of loam, upon which grass grew luxuriantly. At various spots on the surface the ice had melted to a certain depth, forming holes, some of which were full of fresh water. In the others, which were dry, wolves had taken up their abode, and had lain in wait for antelope coming to feed or drink, as was evidenced from the fact that in and around these lairs the remains of dead wolves and of their victims lay in large quantities.

Our road had brought us out at the north end of the lake, from which point the caravan struck east across a ridge of mountains into a plain, to which was given the name of Kiang plain, on account of the immense herds of these animals to be found there. To the north and east of the plain lie the Largot Kangri and Aru Tso ranges. Of these two magnificent ranges of snow-clad mountains, the Largot Kangri runs roughly east and west; and from the east end of that range the Aru Tso mountains run south.

Our road took us into the angle between the two, where, on one of the lower spurs, we encountered a family of Tibetan nomads. These people were here for the purpose of hunting, and obtained their living by drying the flesh of the animals slain and selling it in the villages to the south. After spending a night in their neighbourhood, we, the next morning, marched north-east, and, crossing a snow-clad ridge, entered the upper end of a narrow valley, down which ran a small mountain stream. As we travelled down the valley the rivulet grew rapidly into a rushing torrent; the rocky mountain closed in on either hand; marching became more and more difficult, until late in the

KIANG PLAIN

ALUNG, KANGU RANGE IN THE DISTANCE, 24,000 FEET HIGH

WESTERN TIBET SCENERY

ARPORT TSO.

afternoon we reached the brink of a waterfall 15 feet high, that barred all further progress. On either hand rose enormous precipices, and it became evident that it would be necessary to retrace our steps for a considerable distance before a way of escape could be found. The caravan had hardly covered one mile on the return journey before darkness came on, and the camp was pitched in a narrow barren ravine on the right bank of the stream. On the very brink of the waterfall which had barred our progress, above what appeared to be the highest limit of the rise of the stream, were found the bones of two ponies, and at the foot of the waterfall were lying the skeletons of two others. The surprising thing about these skeletons was that each of them still had on its hoofs shoes of a pattern common in India, but quite distinct from the type used in Tibet. No remains of harness or equipment could be seen, and how these animals came here is still an unsolved problem. A fresh attempt was made at daybreak to escape from the trap we had walked into. The caravan continued up the nullah where we had camped for the night, and entered a promising valley with a considerable stream running in the required direction. The spirits of all rose at the prospect of once more reaching the open plain. One mile further on we entered a gorge similar to the one which had barred our route the previous day. The route, half an hour's weary travel, was found to be absolutely impossible for man or beast. Great ridges of limestone lying at an angle of 45° rose on either hand, while the bed of the stream was filled with immense boulders of concrete. The track of a wild yak was observed, skirting along the mountain-side, and, though hazardous, we determined to make every endeavour to follow this path and to avoid any more *détours*.

Half an hour's severe struggle, and the ponies reached a narrow ledge of shale. The path was all but impracticable, lying as it did in and out of ravines, round precipices, up and down slippery slopes of rock, and over great boulders. However, caught like rats in a trap, we were ready to welcome any chance of escape. Loads were removed dozens of times, ponies were pushed and pulled up places nothing would have tempted them to try by themselves, and the baggage was carried on the backs of the willing drivers. Fortune favoured us, for though many animals fell, but one was lost.

At six in the evening the tired men and animals reached the plain of Memar Chaka, the march of 3 miles having taken twelve hours to accomplish. Snow had fallen daily since we had left Arport Tso, and this had added much to the difficulty of crossing the range.

Memar Chaka, the bitterly salt lake which we had now reached, has an area of about 50 square miles. The plain all around has a width of about 5 miles, the soil being rich and fruitful. Signs were plainly visible of the lake having been at some remote period about 80 feet higher than its present level. But few animals and birds were to be seen.

The country to the east changed considerably in character as compared with that which we had just left behind us, for now low rolling hills took the place of the former rugged precipitous ranges.

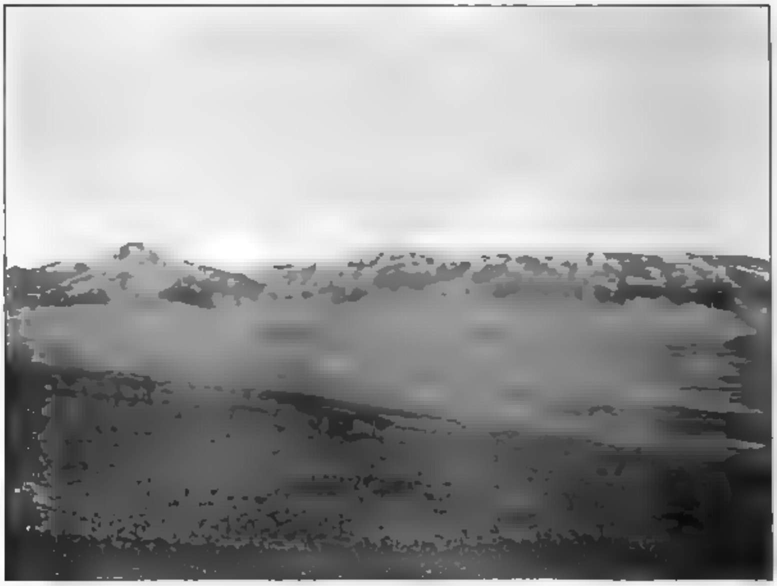
Entering these hills, we met more nomads, who called their valley by the name of Pallo Letok, and who said that they were the first arrivals of the year from Lhasa, and had come for the purpose of digging for gold. Many men, they declared, were already at work in the neighbouring nullahs. The valley in which these people were found was filled from end to end with old diggings, most of which, however, were carried to a depth of only a few feet. It was evident that the spot was rich in the precious mineral, but no information as to the amount of gold to be found could be obtained from our Tibetan friends.

Beyond this undulating range of hills lay a lake entirely frozen over, and having an area of nearly 20 square miles. As the nomads appeared ignorant as to its existence, it was named after the late Surveyor-General of India and called Gore Tso. Round its shores, piled into great ridges, lay a snow-white mass of carbonate of soda and sulphate of magnesia. The outline of the lake was regular, and the shores flat, no vegetation growing within half a mile of the water. On these shores, otherwise destitute of game, I shot a splendid antelope with 27¼-inch horns. Leaving the lake behind and continuing to travel to the east, we found that though grass was plentiful, yet that game remained scarce.

One march further on another salt lake similar in size to Gore Tso was seen, and then we arrived at an unoccupied goldfield, the entire valley for miles being a mass of pits and piles of rubbish. In all probability this field had been worked during the previous year, for the water runs and dams were clear and sharp. From this goldfield we entered an immense plain, along the skirts of which the caravan travelled. Deasy group lay directly to our north, a mighty mass of rock and snow rising to a height of well over 21,000 feet. The passage of this range was one of great toil and privation, two ponies succumbing on the road. The crossing took two days, Antelope plain being reached on July 9.

During the march it was found necessary to climb a peak of Deasy group 20,000 feet in height, in order to find a practicable road. From the summit a glorious panorama was visible. To the north, distant about 60 miles and stretching to the east as far as the eye could see, lay the mighty Kwen Luns, an endless range of snow. At a distance of perhaps 150 miles rose a snow mountain of regular outline, overtopping the remainder by thousands of feet. This great peak we were unfortunately unable to fix, as it was never seen again. To the east and north-east appeared an endless barren plain, while to the south-east and south rose ridge beyond ridge of rugged ranges with open plains between.

LOOKING NORTH FROM DEASY GROUP.



BEACH-MARKS FORMED BY RECEDING WATER.

To the west and close at hand lay a glittering snowfield—truly a glorious scene.

The day after reaching Antelope plain, search parties were sent out to find Hargreaves' camp, with the result that two of his men were encountered. On hearing the bad news about the straits into which Hargreaves' party had fallen, an immediate return to render him assistance was decided upon. The road followed when rejoining this party was that taken by Captain Deasy in 1897, and as this route is known, nothing need be said about it, except that it passes through an arid salt and barren country.

Hargreaves, his party, and the remnants of his caravan were found and brought to a camp, where, in 1900, Captain Deasy, being unable to proceed on his intended journey across Tibet, had buried many pony-loads of stores. Two of our men, sub-surveyor Ram Singh and Soonam Tsering, had been members of his expedition, and knew the exact position of the hidden treasure, for such it was in the circumstances. This was now dug up, and was found on the whole to be in excellent condition. The waterproof sheeting with which the stores were covered had deteriorated, and water had recently soaked through it, partially ruining the Indian corn; nevertheless, much valuable grain in good condition was dug up, and on this the famished ponies were at once fed. Other valuable goods were also found, such as pony-shoes, rice, spices, and flour.

At this camp, which was in a sheltered ravine a few miles to the east of Yeshil Kul, we halted for ten days. During this period ten of the stronger ponies had been sent back to bring on the stores left behind by Hargreaves, while Ram Singh made a journey into the Kwen Lun mountains and along their southern slopes.

While waiting at this camp the country round about was well explored. Game was scarce, but sufficient antelope were found for the requirements of the camp. Borax was found in large quantities close to the tents. The surrounding country was impregnated with carbonate of soda and salt to such an extent that some of the streams were undrinkable. All of us suffered considerably from drinking the water which flowed past the camp, and it was not until a well had been sunk and fair water obtained that the ill effects left us.

On July 24 the ponies returned laden with stores; quite half of these goods we were unable to take on with us, valuable as they were, and so they were buried with Deasy's remaining stores in the old hiding-place. In this hole, and well covered in now, lie seven yalldan of tinned food, besides maunds of flour, rice, etc. I shall be very pleased to give an exact description of the place to any one who may be desirous of visiting this region at a later date.

On July 26 the whole caravan, with the exception of Ram Singh and his party, arrived at the standing camp on Antelope plain, which

was found just as it had been left. Here it became necessary to bury more stores, for tents and instruments had to be carried on, and at this point Ram Singh rejoined us, having done excellent work in the Kwen Luns. For the first few days after leaving us he had found water and grass in goodly quantities, but the face of the country gradually changed, until at last he was forced to return to us, as the ponies were unable to obtain any nourishment on the stony hillsides.

The weather had of late been very hot, on one day the thermometer having registered 70° Fahr. in the shade. Thunderstorms rolled across the plains daily, either rolling up from the west or forming on Deasy group, and generally accompanied with snow.

Fortune now smiled on our efforts to penetrate into the unknown regions to the east, for that which most affected us, namely, grass, sprang up like magic. Three varieties of grass only did we find. The coarsest had a sharp point to each blade, and contained comparatively little nourishment, while the finest was found growing usually in rings round the old root, and extremely rich in nutriment. The ponies, as a result of this good feeding, quickly improved in condition, no others dying during the next six weeks. This was fortunate, for their numbers were now reduced to twenty-four.

With every man and animal laden to the utmost, we left Antelope plain on July 27. When first sighting Antelope plain on July 9, not an antelope was then in sight. On July 27 small herds of from ten to twenty were seen tearing across the plain, coming from the north-east, though never more than one hundred were visible at one time. We naturally thought Captain Deasy must have exaggerated when he said that he had seen them in their thousands. However, one march further on, on climbing a ridge to the north of the camp, a marvellous spectacle met our view. As far as the eye could reach to the north and east, and up to our very feet, were tens of thousands of doe antelope and their young. All had their heads turned towards the north-west, and the animals were steadily trekking in that direction. The glasses only revealed fresh numbers arriving on the distant horizon. Many young ones of only a few days old were resting, but they were not allowed to do so for long, for their mothers continually urged them on. They moved either at a hurried walk or gallop. Where had they all come from, and where were they going to? Probably from some safe and now barren breeding-ground to pastures new in the west, where the young grass was growing rapidly. It was a beautiful sight.

Five marches to the east triangulation was commenced in full view of Deasy group and of the well-known peaks of the Kwen Luns. A good base of 1100 feet was measured, and from this one base the whole of the triangulation was done.

We were now camped on a great rolling grassy plain, but vegetation ceased 5 miles to the north of the camp. A rocky ridge running east

and west lay to the south of us, the Kwen Luns to the north, and Deasy group to the west. From this last group of mountains thunderstorms rolled up in rapid succession. These storms were accompanied by hail and snow and terrible squalls of wind, which at times swept us from our feet and lowered the tents to the ground. Theodolite work was carried on with the greatest difficulty; but after a four days' halt the caravan again moved on.

On August 6 we reached the shores of Lake Markham (named after our President), the first view of which I had obtained on July 9 from Deasy group. Lying roughly north-east and south-west, Lake Markham has a length of about 17 miles, a width of from 4 to 5 miles, and an area of 70 square miles. It is regular in shape, and is bounded on the north by low rolling hills, and on the south by a rugged ridge. Its shores are composed of sand and shingle, and its banks shelve slowly. On its waters and along its shores breed in large numbers the Brahmini duck. No fish or shrimps were seen. A river with a strong current runs by many channels into the lake from the west. The water of the lake at its western end is fresh, but as one travels towards the east the water becomes more and more impregnated with salt, until at its eastern end it becomes undrinkable. At the time of our visiting Lake Markham there was no overflow, the surplus water being apparently absorbed by the soil, or lost by evaporation. There is, however, a narrow channel at the eastern extremity, which at this date was very dry, but which bore evidence that at some season of the year the water escapes by this channel and drains into the low-lying ground to the north, which is white with salt.

Leaving Lake Markham behind and travelling due east, we passed over the northern end of a rocky range running north and south. This range was ended by a fine mountain, from the summit of which triangulation work was carried out, a splendid view of the whole country around being obtained. Though the weather continued stormy, and many peaks were hidden by banks of clouds, yet most of the Kwen Luans could be clearly seen, still covered by a field of snow, and giving origin to numerous glaciers, which filled up and occupied the gaps between the more precipitous hills. The country to the north and east appeared a barren waste. To the east the desert plain stretched for 50 miles, only broken by scattered salt lakes and pans, and by rocky knolls and pinnacles rising abruptly here and there. Beyond this again rose low-lying ranges and rolling hills. All around appeared dead; no fresh water, no vegetation, and no animal life—a veritable Dante's Inferno. As the country could be so clearly seen and easily mapped, it only seemed waste of valuable time to continue our march eastward, so our direction was altered to the south.

The ranges here ran north and south, the valleys between being full of low undulating grass-covered hills. The mountains are composed

of limestone, which was much disintegrated. In the valleys deserted gold-diggings were continually seen. None of these were occupied at this time, but several showed by their fresh-water dams that they had been worked quite recently. Wooden bowls for washing gold, bits of cloth, etc., were also found on the deserted camping-grounds.

As we moved south the altitude lessened, the country improved in character, and game again became more plentiful and of greater variety. Yak, antelope, hares, wolves, marmots, ramchickor, and sand-grouse were seen daily. This change was partly accounted for by the marked increase in the number of small streams running from all the mountain-sides. These streams were not only appreciated by the wild animals, but were also welcomed by us, for during the last three weeks it had been necessary for us to dig daily for our water in the beds of the ravines. Generally speaking, we were successful in obtaining water within a few feet of the surface; at other times, however, only a muddy trickle would appear after an hour's steady work; while again, though never for more than two days in succession, our efforts were all in vain, and man and beast slept waterless.

On August 20 the direction was again changed, this time towards the south-west, the caravan following the line of least resistance. The country to the south-east consisted of great salt plains and jagged ranges. In the centre of these plains lay salt lakes, all of which had the appearance of rapid diminution in size. In some places, in fact, only salt pans remained. The low-lying land for several miles round the lakes was void of vegetation, but on the highlands grass grew luxuriantly and game was plentiful.

Three marches further on the caravan arrived on the shores of Huping Tso, a fine sheet of fresh water almost divided into two by a rocky peninsula. The shore on three sides was flat and boggy, while to the south it was bounded by a rocky range, down whose precipitous sides many small streams added their quota to the volume of water. The lake, however, was mainly fed from the distant mountains to the north, upon whose summits snow still lay. The water was absolutely fresh; nevertheless, no wildfowl were to be seen. In the lake weeds and shrimps abounded, but we were unable to see any signs of fish. A broad and sluggish river, flowing from the western end, carried off the superfluous water, which finally drained into the low ground and salt lakes to the south.

Two marches beyond Huping Tso, within sight of the fixed peaks of the Aru Tso mountains, triangulation was brought to a close. At every mountain-top from which theodolite work had been carried out a large cairn of stones was erected, and this, without doubt, conduced largely to the accuracy of the survey. From this point onwards fixed peaks were always in sight, in consequence of which plane-table work was continued uninterruptedly, until the village of

HÜPING TSO.

SHEMAI TSO.

Noh, on the Tso me Gualari, was reached. During the month of September the sky remained free from clouds, and the annoying wind ceased to blow. In consequence of this, and as there was now no necessity for ascending the highest peaks, the length of the marches was increased. The direction of our route was still west. Before reaching the lake of Aru Tso, the caravan passed many salt ponds, and finally one small but bitterly salt lake. This lake formed the last vestige of what in olden times was a vast sheet of water, and it had without doubt been connected with Memar Chaka and Aru Tso. The old shores could be distinctly seen high up the mountain-sides. This lake must formerly have had an extent of over 70 square miles. A strong fresh-water stream runs into this salt pond from the south-west. On the banks of this stream the grass grew luxuriantly, and amid this moved great herds of antelope and gazelle.

Aru Tso was reached on August 29. On the shores of the lake the caravan halted, and here a most interesting and also important fact was noticed—the waters were fresh. Captain Bower visited this lake in 1890, camped upon and moved along its shores, and writes, "Like most Tibetan lakes, it is, of course, salt." Captain Deasy reached Aru Tso in 1896, and his report on the water was that it was drinkable—a term which, when used in reference to Tibetan travel, means that the waters are decidedly saline or foul. And now on our journey in 1903, at the end of August, the water was found to be fresh, absolutely fresh, without the slightest trace of salt or disagreeable mineral in it. This is certainly worth recording, if only for the reason that, as this change has been shown to take place in one great lake of the Tibetan plateau, it is quite possible that at certain seasons or periods other lakes may become altered in character. It is to be hoped that in course of time Aru Tso will again be visited, and its water carefully tested.

The caravan passed round the southern end of Aru Tso, crossing an almost endless number of streams, all fordable, but treacherous on account of the quicksands. In the plain to the south and on the slopes of the hills, game was seen in great variety and numbers. Female and young Ovis ammon, bushel, antelope, gazelle, and yak were seen everywhere; the place is a veritable sportsman's paradise. The Aru Tso mountains run north and south for many miles, the western shores of the lake lying close to the foot of the range. These mountains are rugged and precipitous, and their summits are clothed in perpetual snow. The range would be impassable were it not for two cuttings opposite the southern shore of Aru Tso, where two streams have cut their way from the west right through the range. The passage through these openings is easy, as the beds of the streams are almost on a level with the waters of the lake. On debouching from these ravines, both of which were traversed, we met a family of nomads living as usual in coarse cloth yak-hair tents. With them were a herd

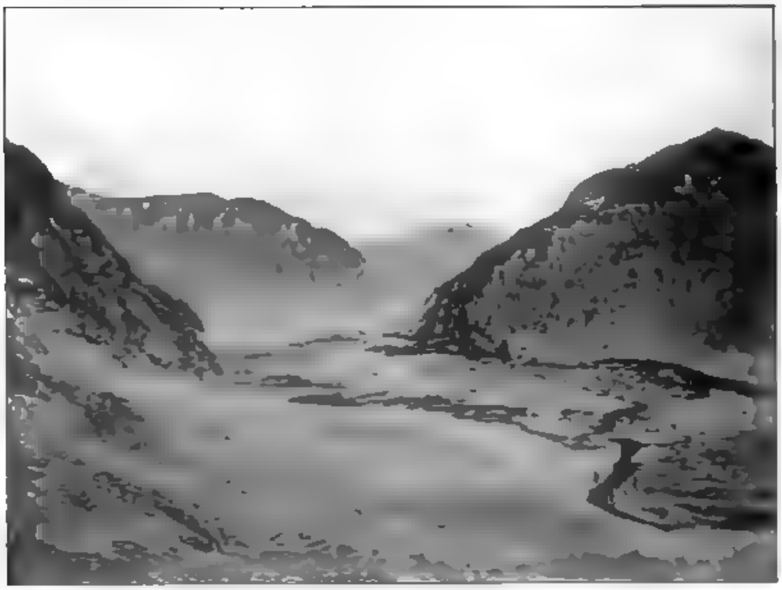
of about 1500 sheep and goats, and a few yak. From these people we hired a few of the latter to assist our ponies; but no supplies of food could be obtained, for, except animals, they had no visible food with them; in fact, their first request to us was to know if we had any suttoo to give them. The elder of the two men accompanied us as guide and yak-driver.

Reinforced by this welcome addition of transport, the caravan travelled through an open undulating valley, teeming with wild yak.

On the third day we unexpectedly came upon and halted close to an old Tibetan, who was, together with his son or grandson, living beneath an overhanging rock. These two proved a curious couple, for the old man must have been between sixty and seventy, and the child about five. They were not at all concerned at our sudden appearance, and, after salaaming, continued cooking their meal without more ado. Their repast consisted of wild ass flesh, upon which, together with tea, they declared they had been living for the last six weeks, during which time they had been digging for gold. A pile of earth lay some little way up the river awaiting, for the process of washing the arrival of the remaining members of the family. The child deserves notice if only for the Spartan manner of living. Though only five years of age, flesh formed his only article of diet. He was clothed in a short cotton shirt, which only descended to his thighs. Though the thermometer at night-time registered 18° of frost, yet, on rising the following morning at daybreak, this child was seen in these rags preparing his father's breakfast, and apparently quite insensible to the chilly atmosphere. On the caravan moving off, he refused a mount on a pony, and waded cheerfully through the river, breaking the ice at every step. We had now parted from our late guide, and were handed over to the tender mercies of the old man and his son. The former told us that he had heard early in the season that we were in Tibet; also that the Rudok officials had received full information of our intended journey. The Rudok army (?) had been sent out in all directions, with orders to find us and turn the caravan back. These people had all returned to their homes within a fortnight, after a fruitless search, with the report that we had gone into Chinese Turkestan. Our new guide, therefore, when he saw us, guessed at once that we were this very party, and decided that we had not come to rob him.

For two marches we bore south, traversing an extensive, stony, and almost waterless plain. The mountains on either hand were black in colour, those on the east being covered with snow, whilst immense herds of wild yak were to be seen grazing in all the valleys in this direction. At the south end of the plain, after an easy ascent and a sharp descent through a narrow gorge, the caravan debouched into a long narrow plain, which might almost be termed a valley. The soil of the pass over and through which we had passed was composed of

WILD YAK



KHEO VALLEY ABOVE NOH VILLAGE.

sandstone, and appeared to be a home of the Tibetan sand-grouse. These birds were so ridiculously tame that even when fired into when on the ground they refused to fly, and continued waddling along quite unconcerned.

The valley we had now entered runs east and west, and deserves more than a passing notice, for it is well known to the Tibetans, and will become much frequented in years to come, since it forms one of the trade routes between Rudok and Lhasa. At its eastern end it is shut off by immense rocky mountains, black in colour, and covered by snow and immense glaciers. The whole northern side of the valley is bounded by a long range of low mountains of sandstone and shale, destitute of water, vegetation, and animal life. Ten miles from the eastern end of the valley the formation of the range bounding the southern side of the plain becomes similar to the northern. In the eastern plain itself and in the mountains near by grass grows luxuriantly, and here game abounds. Great numbers of old fireplaces proved what a favourite spot this is at some seasons of the year for nomads with their herds of sheep and goats. At the time of our visiting it (September 5) no Tibetans were to be seen, probably for the reason, as our guide informed us, that the shepherds were attending a festival near Rudok.

Travelling due west for three marches, the last two of which were along the banks of a fresh-water stream, we reached the shores of Bum Tso. Bum Tso has an area of about 5 square miles. It is a shallow lake, and is surrounded by flat muddy shores. The water is drinkable, but has a distinctly foul flavour. This without doubt results from there being no continuous overflow, though the lake is perpetually fed by the broad stream along which we had been previously travelling. In all probability Bum Tso overflows its banks at some season of the year; otherwise its waters would be salt. Geese, duck, and teal were seen on the water and on the shores in countless thousands, but, on account of the absence of cover and of the depth and softness of the mud, a near approach was found to be very difficult.

When we left this lake behind, a long and trying march carried us over an easy but barren and waterless pass to two fresh-water ponds, and close to a camp of three tents inhabited by Tibetans. Though much frightened at first, these people, nine in number, seeing that we were not a band of robbers, soon made friends, and brought us milk, fuel, etc. We were told by the oldest man that a famous goldfield lay distant 7 miles, on which five hundred labourers were employed. This place we determined to visit the next day for the purpose of obtaining provisions, for we were completely out of all food-stuffs with the exception of meat and tea.

Next morning, however, we were awakened early by an angry harangue outside our tents, and we soon learnt that forty Tibetans, armed with every imaginable weapon, from the gun to the bow and

arrow, had collected to bar our further progress. Persuasion and argument proving useless with them, we ordered the tents to be struck and the march to be resumed. This was apparently the last thing the Tibetans expected us to do, for they did nothing but converse amongst themselves, and, when we moved off, followed about half a mile in rear in a compact group. We advanced likewise in close formation, with the ponies kept well together in the centre. The enemy, however, was continually receiving reinforcements, for men appeared from all directions, springing out of nullahs as if by magic.

The numbers of our opponents soon swelled to between sixty and seventy, but though they closed round us, they could not make up their minds to attack until the arrival of a red lama. I must here mention that though some of our men were carrying carbines and guns, yet before leaving camp Lieut. Hargreaves and I had taken care that they had no ammunition with them, for we were determined that nothing would persuade us to fire unless we were actually fired upon by the Tibetans. This they seemed unwilling to do, but, urged on by the lama, they came to close quarters and tried to seize us. A running fight now ensued, not with guns, but with sticks, butts of rifles, hard knocks being given and returned. The noise was appalling, the Kashmiris, well in the centre and out of harm's way, shouting the loudest. The scrimmage was brought to an end by the Tibetans one and all suddenly dropping their guns and rushing in upon us. We were completely outnumbered, and so were soon in a powerless position, being held firmly by arms and legs. We then smiled upon our enemies and patted them on their backs, a thing which much astonished them and caused them to release us. The ponies, who had stampeded at the noise, and many of whom had fallen and were struggling on the ground beneath their loads, were then collected, and a pow-wow took place. No result was arrived at as to which direction we should proceed, but after two hours' talking it was arranged that we should return to our late camp, and there await the arrival of the headman of the district (who was reported to be on his way), while in their turn the Tibetans agreed to bring us the articles of food we were most in need of.

During the night fresh comers were continually arriving, and with them came the headman. We demanded an apology for having been insulted, and when this had been freely given, the chiefmen were brought into our tent, and the argument began afresh. As stores in the way of suttoo, sheep, ghoor, etc., had been brought during the night, the only thing we had to discuss was as to the route we were to follow. We insisted upon going straight to Rudok, and the Tibetans were determined that we should return by the way we had come. Finally, and after much talk, it was settled that we should move due north straight into the mountains, both parties having conceded an equal amount. We parted that day the best of friends, after having

obtained much valuable information, for they spoke freely on all subjects with the exception of the richness of the goldfields, about which we could learn nothing.

We now entered upon the hardest and most trying part of our journey. The country had originally been a plateau, but was now cut up by endless ravines with precipitous sides of sandstone, broken here and there by slopes of conglomerate. Mighty pinnacles rose in all directions, sometimes to a height of 200 feet or more. Water and vegetation were practically non-existent; nevertheless great herds of bushel were always in sight, living upon nothing so far as we could see. Men and ponies suffered much from the want of water, three of the latter succumbing during the first three days.

Survey work, however, was continued without a break, even under the watchful eyes of the old lama, who had insisted upon accompanying us, much against our wish. This lynx-eyed attendant failed, however, to keep up with Ram Singh and his pony when climbing hills, and we took care to load the riding-pony he had brought, in order to damp his ardour. Astronomical observations were taken nightly without hindrance. The Tibetans never objected to the use of the theodolite, though they showed great dislike to the plane-table. For the purpose of taking observations, we used a subterfuge as practised by Captain Bower in Western China. We showed them the instrument, and explained that it was used for saying our prayers with, and as such, when on its stand, was on no account to be approached by any Tibetans; also that such was its delicacy that not a word was to be said while it was in use. Though the theodolite was used often amongst a large collection of the natives, never once were we disturbed or questioned.

Crossing the dried-up bed of Tatar Tso, the caravan entered a practically waterless valley, bounded on either side by immense precipices, unclimbable by either man or animal. During the next five days we only discovered fresh water twice, whilst grass was conspicuous by its complete absence.

Tai Tso, a series of fresh and salt water pools, was reached on September 18. These ponds were reported by the lama, who had of late constituted himself our guide, to be bitterly salt. Being surrounded by mounds of snow-white chalk and sand having the appearance of salt, this statement at first sight appeared to be correct, but as the waters and shores were covered with geese and duck, we quickly proved that such was not the case. The shores for half a mile all around were entirely covered with the remains of ammonites and fresh-water molluscs. Weeds grew luxuriantly in the water, and amongst these weeds moved myriads of shrimps. All around were thousands of geese, pintails, pochards, and other ducks, while close by a woodcock and a snipe were bagged. A little further on, growing in the hollow of the valleys, were some dwarf shrubs, the first wood we had seen for over

four months. Here hares were met with in great numbers, forty-three being put up within ten minutes. One march beyond Tai Tso our troubles ceased, for we entered into a land of plenty on the banks of the Khio river. This beautiful river poured out from a valley to the east, through meadows of rich short grass. From 30 to 100 yards wide, with a current of 2 miles an hour, it steadily increased in size, being continually fed by springs rising on every side. The bed at times was stony and firm, at others muddy and treacherous, though everywhere weeds grew freely and trout moved fearlessly along.

On September 21 we met more nomads, tending large flocks of goats and sheep. As we very well knew that these people took the information of our approach to the people of Noh, we took the bull by the horns and sent a letter by our lama guide to the Zung of Rudok, with a request for provisions and transport. The following day we were met by a rather truculent band of Tibetans, led, as we afterwards found out, by the bully of the district. They again requested us to turn back, but this time we were determined to have our way, and consequently continued our journey the following day, passing close to, but not entering, the village of Noh, and camping on the banks of the river just beyond. Noh appeared to be a prosperous village containing a population of about five hundred, living in eighty houses substantially built of stone and bricks. There were two monasteries gaily bedecked with linen prayers, coloured rags, and bunches of shrubs. We here received a letter from the Zung of Rudok, saying that he had ordered supplies and transport to be given us. His men, with tsampa, grain, ghi, etc., were camped close at hand, and, I must say, made themselves quite agreeable. We obtained everything we required, though at exorbitant prices, and with the usual endless bargaining of the East.

Many Tibetans accompanied us for two marches to Pal, we will hope simply from friendly motives. The road was a good one and clearly defined; it lay along the shores of Tso Nyak and the twin lakes of Rum Tso. Exquisitely beautiful lakes they are, the water of crystal clearness, in which were myriads of shrimps darting amongst the weeds. The shores were sandy, and the banks firm. Wild rugged mountains rose all around, those beyond Rudok capped with snow. Game birds were plentiful, and the natives reported that the lakes were full of great trout. The Tso Mo Gualari consists of a string of five lakes 120 miles in length, the four most southern of which are fresh, and Pangong, the most northerly, salt. They are joined together by channels about 60 feet in width and 15 feet deep, the current running at nearly 1½ mile an hour. At Pal was another camp guard, placed there to prevent any one entering Rudok district from Ladak.

And now we entered known and accurately mapped districts. The country was barren and inhospitable, but we were again close to British territory, so difficulties and troubles were cheerfully overcome.

On October 3 we crossed the Kien La, 18,600 feet, then once again the Marsi mik La, and camped that night in Ladak. Tankse was reached three days afterwards, and Leh on October 12.

Altogether our travels carried us over 8000 miles of country, the greater part previously quite unknown to the European, while an area of 35,000 square miles was accurately surveyed.

The success of the expedition was mainly due to my staunch and cheery companion, Lieut. Hargreaves; to our ever-willing, hardy, happy-go-lucky Lavaki servants; and to Babu Ram Singh, the sub-surveyor, whose excellent work gained him the title of Rai Sahib.

To Colonel St. G. Gore, late Surveyor-General of India, to Mr. Eccles, of the Survey of India, and to Major Ray, Intelligence Branch, who most kindly gave us every assistance and advice, I take this opportunity of tendering our sincerest thanks.

PTOLEMY'S MAP OF ASIA MINOR: METHOD OF CONSTRUCTION.

By the Rev. H. S. CRONIN.

THE first condition of any study of Ptolemy's map is to disabuse our minds completely of the notion that we have in it a map which is accurate according to modern conceptions of accuracy, or which was constructed on modern lines. Such map-making, indeed, was beyond the means at Ptolemy's disposal—he had but few observations, none of those he had were strictly accurate, and he had no means of taking better ones. In any case, his map is not accurate. It is far too large. The distance from Issus to Rhodes should be 420 miles. Ptolemy makes it nearly 500. The distance from Rhodes to Chalcedon should be about 300 miles; he makes it over 400. Initial errors, so considerable as these, make themselves felt everywhere. They affect, for instance, the area; it is fully half the size again it ought to be. They affect the boundaries. Rhodes and Chalcedon being 100 miles too far apart, the whole western coast between the two has been pulled in towards the east. Ptolemy's western coast of the Troad is therefore about 70 miles from the line joining Rhodes and Chalcedon; it should be twice that distance. Again, this removal eastwards of the western coast has led to compression all along its course. Ptolemy's Cyzicus, for instance, is some 50 miles from his Nicæa—it should be 96 or 97—while the towns along the road which joins them are huddled together. Turning to the other boundaries, the northern is distorted, the southern is far too straight, and the eastern boundary for much of its course runs due north and south. In the interior of the map, places tend to move towards the centre. Compare, for instance, the positions of Laodicea, Antioch, and Amorium on Ptolemy's map and in reality.* All this had to be to fill the map, and, without going into further details, we may note that the first principal and constant cause of Ptolemy's mistakes is this initial mistake, however he arrived at it, of making the area of Asia Minor so very much too big.

The second principal cause was the insufficiency and vagueness of the bulk of

* Cotiæum is an exception only in appearance. It has moved south and east, but the western coast was also moving east.

the information, as much about the coast as about the interior, which he had at his disposal. He had an observation for Rhodes, which, if not strictly correct, may be allowed to pass. It is not so with his observations—if he had them; and I half incline to think he had—for the latitude of Smyrna, the Hellespont, Byzantium, Issus, and Trapezus. These are out, some of them very much out. To discuss the reasons, which led him to put these places where he did, would lead us too far from our subject. We should have to take into consideration facts, or supposed facts, outside Asia Minor which contributed to fix their position. It simplifies our problem to assume—and it is a fair assumption to make from the prominence, and the kind of prominence, Ptolemy gives to these localities, and it is probable enough in itself—that, when he left the map of the world and settled down to construct the special map of Asia Minor, the situation of these places had been fixed to his satisfaction, if not to ours; this assumption is made practical certainty by an examination of his map. Other observations, as far as we know, he had none. On the contrary, he had sometimes to rely merely on travellers' notes, often vague as to distance, and even vaguer as to bearing; the vaguest being that such and such a place was so many hours or days from such another place, or lay towards the north or the south. Vague and unsatisfactory by land, winds and currents would make these indications still less trustworthy by sea; and though Ptolemy claims that sea-coast towns are easier to place than inland towns, because their position relative to each other can be more easily shown, he does not find them very tractable. Precise indications of bearing there would be none; precise indications of distance would be found in practice only along the Roman roads; and even these roads, accurate as the information which they give may be, so far as it goes, afford no clue to the bearing of place from place, or to the allowance which had to be made for windings. These two things, then, were against internal accuracy. The area of the map was very much too large; the materials for constructing it—even the best of them—lacked completeness. The first drove Ptolemy to treat his materials in an arbitrary manner; the second, if it did not actually tempt to such treatment, could present no serious obstacles to its adoption.

Arbitrary, however, as many of his results appear, no one could have more desire than Ptolemy to treat his materials fairly, and no one could be more conscious of his lack of material, or of the disturbing effect this lack must have on his results. Arbitrary, indeed, is hardly the word to apply to Ptolemy, for it is clear that he had a method, and, considering everything, a good one. His materials are at fault; and if they are partly responsible for the defects of his method, no method, however good, could have eliminated confusion altogether from results built on information never complete and often contradictory.

The publication in 1901 of the second part of the first volume of Müller's 'Ptolemy' has made the task before us considerably easier now than it was three years ago, but great difficulties still remain.* Accuracy of transmission, always difficult to secure where copyists are concerned, is particularly difficult in the case of figures. We cannot, therefore, be certain always that we have the right reading. Recent exploration has done much to fix the sites of the more important towns, but some still remain uncertain; and we are still without definite information as to the length and course of the roads which joined some of those towns, the sites of which are definitely ascertained. Yet we now know something for our

* I have adopted Müller's readings throughout, and as a rule his spelling. The information he has collected in his notes has often been of considerable service to me; so, also, have been his maps in the preparation of the maps which accompany this article. The work, which is published at Paris by Firmin-Didot, was left incomplete at Müller's death, and is being continued by Fischer.

purpose, especially if we bear in mind that Ptolemy's map does not aim at precise accuracy, and that positions on it are indicated by twelfths of degrees—that is to say, only within 4 or 5 miles.*

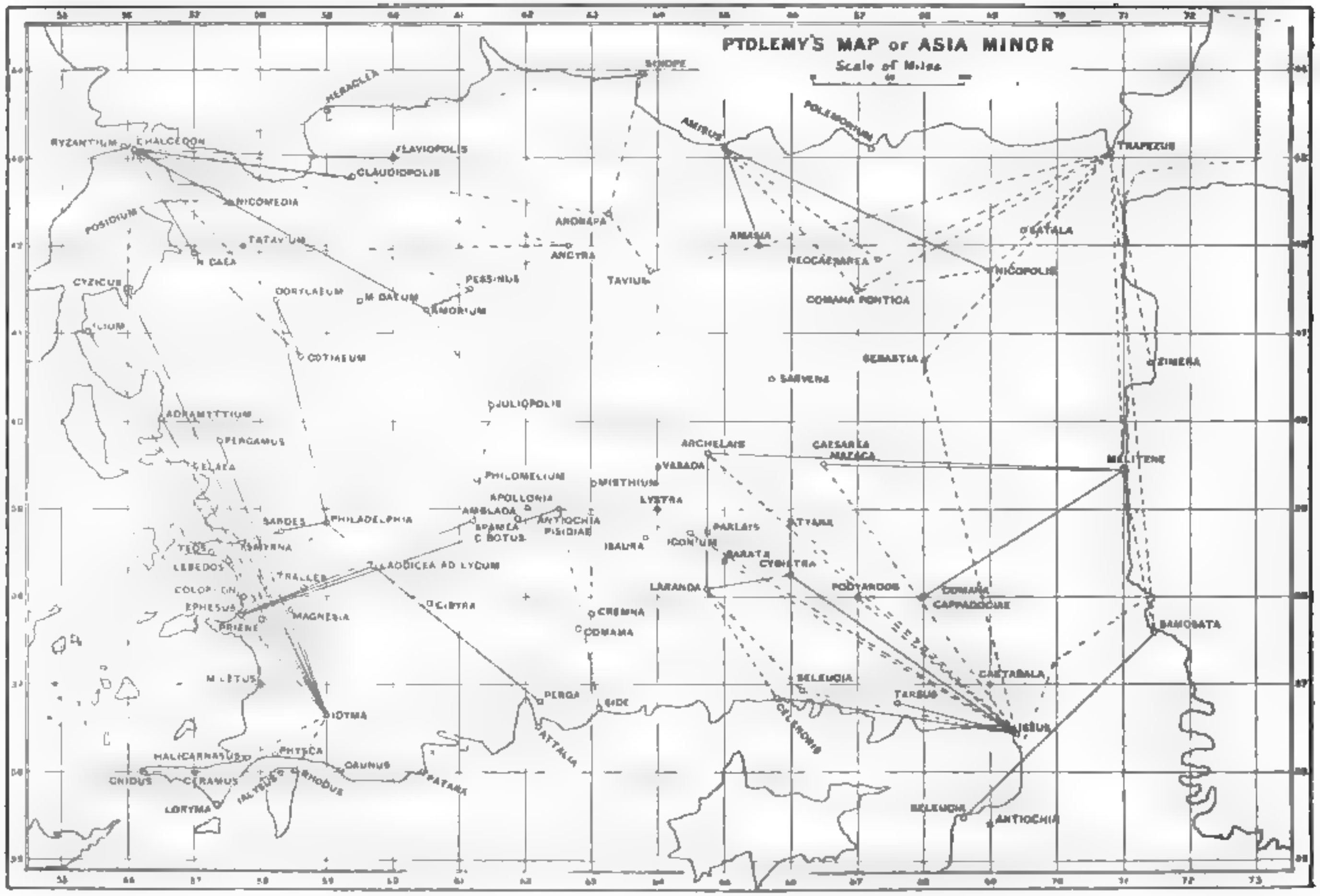
Our best plan now will be to take a map constructed from Ptolemy's figures, and to see what that can tell us of his method, or of his lack of method, in constructing it, and to begin its examination from Rhodes—that is to say, from the south-west corner of the map—working from thence up the western coast. The south-west corner is characteristic of Ptolemy and his difficulties—I believe, also, of his methods. Rhodes figures largely in Ptolemy's introduction, and is for that reason, as well as for others, a natural place from which to begin, while the outline of the coast, or at all events the positions of the more important sites along the coast, would have to be determined before the task of fixing the positions of places inland could be approached.†

Travellers going north from Rhodes would land at Physca (or Physcus), whence a road led to Ephesus by Idyma (or Idymus), Tralles, and Magnesia. Physca lies almost north of Rhodes, at a distance of 30 miles. Ptolemy places it almost north-west, and at a distance of 23, an error of 7 miles in distance, and of half a right angle in bearing. I have, however, just pointed out that Ptolemy's unit is a twelfth of a degree, so that the 23 miles may represent as much as 28; probably in this case it does represent as much as 25 or 26. Moreover, when I said that the distance from Rhodes to Physca was 30 miles, I meant that that *is* the distance according to modern maps; I did not mean Ptolemy knew that it was such. A successor, indeed, of Ptolemy makes it 28, and as distances at sea were hard to estimate, there were probably other estimates placing it even lower. Now, just because sea-distances were hard to estimate, any such estimate, when obtained, would be the less convincing, and accordingly the less able to resist the claims to consideration of other and conflicting *data*, when such existed. In the south-west corner of Asia Minor such claims do exist in considerable force. A comparison of the two maps will show how much the coast winds; that Ptolemy had no exact information of its windings, and that, as he practically ignores them and makes the coast-line nearly straight, he gets into great difficulties. Loryma and Cnidus are, for instance, far from where they ought to be; and the length of the south coast west of Physca is such that, if its windings are neglected, the proper northern coast is not long enough to match it. Ceramus has been carried west of Halicarnasus; Idyma, to which we shall return shortly, is made apparently an inland town, 58 miles (or roughly its right distance from Halicarnasus) from the sea. To put it briefly, the course of the whole coast-line has been changed, and the Ceramic gulf more or less suppressed.‡ In such circumstances—and I can only sketch them

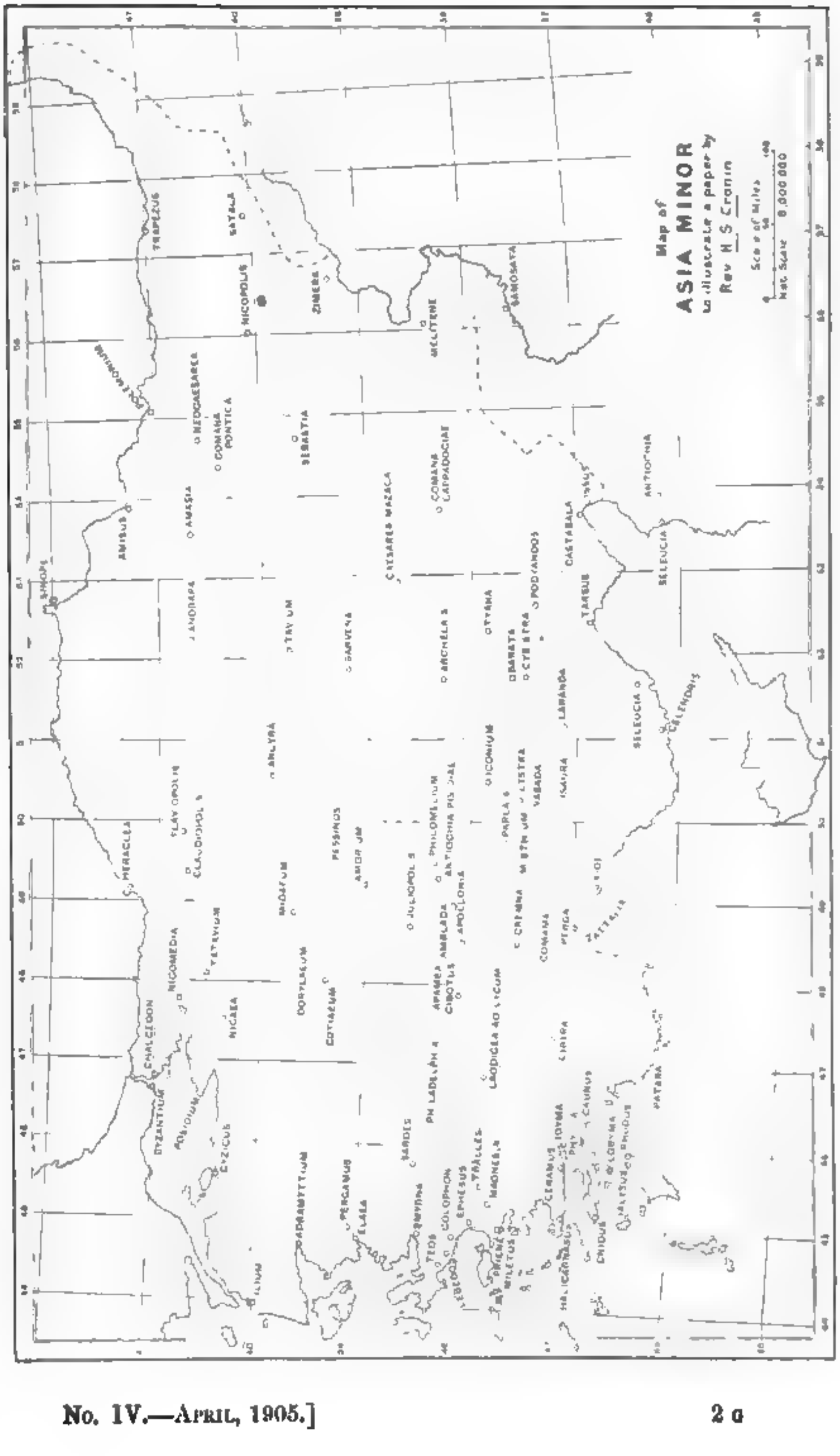
* For the special maps, Ptolemy treated both meridians and parallels as parallel and straight lines. His degree was 500 stades, or approximately 58 English miles; the proportion of a degree of latitude to one of longitude in the map of Asia Minor was 4 to 3 (Ptolemy, 'Geographia,' 2, 1, § 9; 8, 2, § 6 and ad πιν. 'Ασ. δ). The minimum margin, therefore, would be a little under 4 miles measuring from east to west, and *vice versâ;* the maximum, along a diagonal, a trifle over 6. Ptolemy may have chosen either the corner of the parallelogram nearest to where his *data* placed the town, or, perhaps, the most convenient.

† The position of Rhodes is not given in Book V. of Ptolemy's 'Geography;' for some reason or other it has fallen out. Its position, however, can be recovered from the eighth book, and it is 58° 40′, 36° (cf. Müller, p. 838; Book VIII. is not yet published).

‡ Mr. J. L. Myres, who has kindly made many useful suggestions to me on the subject of this paper, tells me that native sailors try to avoid the Ceramic gulf. Is the opening marked in the Peutinger table between Myndus and Cnidus the Ceramic gulf, such as Ptolemy perhaps conceived it, or the Meander, which is not represented in its proper place?



PTOLEMY'S MAP OF ASIA MINOR
Scale of Miles
SINOPE
AMISUS
POLEMONIUM
TRAPEZUS
HERACLEA
BYZANTIUM
CHALCEDON
FLAVIOPOLIS
CLAUDIOPOLIS
NICOMEDIA
POSIDIUM
TATAVIUM
ARONAPA
ANCYRA
TAVIUM
AMASIA
SATALA
NEOCAESAREA
NICOPOLIS
COMANA PONTICA
CYZICUS
DORYLAEUM
PESSINUS
AMORIUM
ILIUM
COTIAEUM
SEBASTIA
ZIMERA
SARVENA
JULIOPOLIS
ADRAMYTTIUM
PERGAMUS
ARCHELAIS
CAESAREA MAZACA
MELITENE
VASADA
PHILOMELIUM
MISTHIUM
APOLLONIA
LYSTRA
SARDES
PHILADELPHIA
AMBLADA
ANTIOCHIA PISIDIAE
APAMEA
TYANA
PARLAIS
ICONIUM
ISAURA
SMYRNA
TEOS
LEBEDOS
LAODICEA AD LYCUM
BARATA
CYBISTRA
TRALLES
COLOPHON
LARANDA
PODYANDOS
COMANA CAPPADOCIAE
EPHESUS
MAGNESIA
CIBYRA
CREMNA
COMAMA
PRIENE
SAMOSATA
MILETUS
PERGA
SIDE
SELEUCIA
CASTABALA
TARSUS
ISSUS
DIDYMA
ATTALIA
CELENDRIS
HALICARNASUS
PHYSCA
CAUNUS
CNIDUS
CERAMUS
RHODUS
IALYSUS
PATARA
LORYMA
SELEUCIA
ANTIOCHIA


Map of
ASIA MINOR
to illustrate a paper by
Rev H. S. Cronin

now—Ptolemy would be glad to place Physca as far east as possible, and of two estimates of its distance from Rhodes would choose the shorter. The proceeding might be desperate for us; unhampered, as he was, by too accurate knowledge, it was a natural expedient for him.

Suppose, then, we take Ptolemy's map, place one point of a pair of compasses on Rhodes and the other point on Physca, turn the second point round until it rests on the line joining Rhodes and Idyma, and measure the distance between it and Idyma; we shall find that it measures 15 miles. The site assigned to Idyma is Guiova, at the head of the Ceramic gulf, and the distance of Guiova from Marmario (Physca) is 14 or 15 miles, the distance we have just obtained.* Idyma, then, is, I do not say the right distance from Rhodes, but the distance which Ptolemy apparently thought Physca was from Rhodes, *plus* the right distance from Physca to Idyma by land.† Its insular position prevented Rhodes from serving as a general centre of measurement for the mainland. Physca, the port for Rhodes on the mainland, would be its natural representative; it was, however, not available for such a purpose—the claims of the south coast had carried it too far west—and it is not so used. Idyma, on the other hand, the next town along the road to Ephesus, and a town away from the southern coast, was available, and measurements from it yield some interesting results.

The first places on the west coast to be fixed would be Ephesus, Smyrna, Adramyttium, Ilium, and Cyzicus. Ptolemy's map-distances for these places from Idyma are 87, 129, 221, 296, and 304 miles respectively. Placing Idyma at Guiova, and measuring the distance by road to Ephesus, and then on, we get, as nearly as I can calculate, the following results: Idyma to Ephesus, 84½ miles; Idyma to Smyrna, 125 or 126; to Adramyttium, 224; to Ilium, 300; to Cyzicus, 300; that is to say, the map-distance is sometimes 2 or 3 miles too much, sometimes 2 or 3 miles too little—it is never out a twelfth of a degree. Such correspondence is not true of every place along the coast, and between these distances and the air-distances there is no correspondence at all. In spite, therefore, of the risk there must be of slight error in calculations of this sort, it would not be rash to say provisionally that these five places had been specially picked out—reasons for their selection would not be hard to find—that their positions had been fixed partly by their road-distances from Idyma, as representing Rhodes, and that no allowance was made for windings, although, as it is very much to our purpose to observe, the road winds a great deal. I shall return to this point later. Suppose, however, this were done, Smyrna would be where a circle with Idyma as centre and the road-distance from Idyma as radius cut the parallel of Smyrna; the parallel of the Hellespont would fix the site of Ilium; while Cyzicus would be fixed by its sea-distance from Byzantium, a distance apparently measured by Posidium, and not too much to be trusted.‡

The position Ptolemy assigns to Ephesus is instructive. He places it 53 miles due south of Smyrna. The correct position is 37 miles a little east of south; the

* It is not unusual, as we shall see later, for Ptolemy to calculate the distance of A from B *viâ* C, and then, if necessary, to place C right away from the line which joins A and B.

† Land-distances were more easily measured and not so easily adjusted. Idyma has approximately the right bearing from Rhodes. The road from Physca to Idyma is nearly direct.

‡ It would not be difficult in any of these cases to choose between the two points where the circles, or the circles and parallels, intersected. Elsewhere it has been less easy, and mistakes have led to great confusion.

road-distance is 41 English miles, which corresponds, as nearly as we can expect, considering the way the map was made, with the difference in the map-distances of Smyrna and Ephesus respectively from Idyma. But though Ptolemy seems to know the distance and to use it when it suits, he also disregards it when it suits. He could not place Ephesus on the line joining Smyrna and Idyma—it would be too far east. He could not, if my hypothesis is true, go back on his measurements from Idyma, and place Smyrna further south or Ephesus further north. Moreover, if the whole western coast was to be pulled out, the coast-line between Smyrna and Ephesus would have to do its share. To do as he did was obvious; probably on the whole his solution was not so very inconsistent with his facts, especially as the coast road * would give him most of the statistics he required to justify his action. We have here both the effect of the influence of the initial error, and another instance of the practice to which I have already called attention, in the case of Rhodes, Physca, and Idyma, of measuring from A to B *viâ* C, and placing C right off the line which joins the two.

As we are at Ephesus, we may as well discuss the evidence of the trade-route, and therewith the question of the way in which Ptolemy dealt with the interior. Magnesia is some 14 miles from Ephesus, and lies south-east; Ptolemy places it 40 miles away and slightly north of east. Tralles is 28 miles from Ephesus, and lies east-south-east; Ptolemy makes the distance 50 miles, and the bearing nearly north-east. So far no method is apparent, but when we take the principal road-centres along the road—Laodicea-ad-Lycum, Apamea Cibotus, and Antioch—we find the road-distances agree as closely with the map-distances as they did in the cases examined on the western coast. The inference again is that the roads were used, that they were treated as straight lines, and that, as we might expect, the chief road-centres were fixed first. The trade-route, or its continuation, gave one clue; measurements from Perga in the case of Laodicea, measurements from Side in the case of Antioch—again the map-distances and road-distances practically agree—would give the other.

Now, with regard to his treatment of these roads, it is natural enough that Ptolemy should use the valuable information they afforded; it would be unreasonable to expect detailed acquaintance with their windings, but the apparent absence of all knowledge that they did wind—at least no indication thereof in practice—is hard to understand.† But suppose he had been able to ascertain the correct air-distance, say, to Laodicea from the coast, suppose he had fixed its position accordingly, and suppose he could have done the same for other places, what would have happened? Every place which occupies the centre of his map would have moved by so much towards the coast, and would have left a space in the middle of the map roughly 100 miles wide by 300 miles long without a town in it at all.‡ What else, then,

* For much of his perimeter *data*, Ptolemy would depend also on the track of a circumnavigating vessel.

† Ptolemy is, as a matter of fact, aware of what he was doing, and speaks with regret (Bk. i. 2) of his ignorance of the windings of the roads. Would anything else, however, have served his purpose and led, on the whole, to better results, except a knowledge of details altogether beyond his reach? Would, moreover, the extent of error, introduced by the neglect of the windings, be as obvious to an Egyptian as to a native of a mountainous country? Roman roads, moreover, are straight, and Ptolemy was a geometrician rather than a traveller. Since writing the above, I have come across two passages in Bunbury ('History of Ancient Geography,' 2, p. 27, and 1, p. 642) which bear on this question (cf. Bunbury, *op. cit.*, 2, p. 27).

‡ The same, albeit perhaps to a less extent, would have happened if a fixed allowance had been made for windings.

could he do, in order to do justice to all his facts, but place Laodicea as far from Ephesus as his information made possible, and, *mutatis mutandis*, treat other selected places in the same way? With regard to intermediate places, Magnesia, for instance, or Tralles, he would naturally deal with them later, and to be consistent, he ought to have placed them at their proper distances along the line joining the two road-centres between which they came—*i.e.* to take the case before us, on the line joining Ephesus and Laodicea. This, at all events, he does not do. The road gives him the distance from centre to centre. He recognizes its existence afterwards to this extent only—he places intermediate towns at more or less appropriate distances about its course; but otherwise its direct course is ignored. The positions of these latter towns are determined on no fixed principle. Sometimes Ptolemy was guided by their distance from one or other of his centres; sometimes by the distance between place and place; sometimes, it must be confessed, by the effect produced on the general appearance of his map. The district, for instance, which we are considering, lying as it does towards the west, has been influenced by the course Ptolemy has assigned to the western coast; various western towns are therefore too much to the east, and have usurped positions which belong to other places. Priene, for example, is, relatively to Ephesus, almost where Magnesia ought to be. In other words, results already obtained demanded that freedom of handling which Ptolemy's materials tolerated, and made him glad to avail himself of reasons for moving Magnesia and other places also to the east. Measurements from Ephesus were unmanageable, and were ignored in favour of others, so that we find that, within the usual limits, Magnesia is its right road-distance from Idyma, as well as from Tralles, which, in its turn, appears to go back through a series of windings to Laodicea.

It appears to me most natural that in his treatment of the roads Ptolemy should adopt the method I have described; any other method—he probably tried others—would have led to trouble. Its naturalness is a great presumption in its favour. Nor are proofs of its adoption lacking; I have already given several instances. I have indicated on the map by lines certain others which I consider likely, dotted lines, as a rule, denoting those measurements of which I have a little doubt, or for which the *data* are not quite satisfactory. The instances could be increased, but, allowing for an occasional desertion—and the risk of error in measurements and calculations of this kind must not be overlooked—they are, I think, sufficient in number to make my hypothesis exceedingly probable. The evidence, moreover, afforded by such general correspondence between map-distance and road-distance for road-centres along main roads, must be taken in conjunction with the absence of similar phenomena where, on my hypothesis, it would not be expected.

The authorities on which these measurements are based are most conveniently given in an appendix (see p. 438); a few points, however, which arise from an examination of the map require notice here.* We should have expected the triangulation of the map to have been built up from Rhodes, or rather from a base measured from Rhodes. As a matter of fact, for the interior there were four main centres of triangulation, and four independent systems—Idyma, the representative of Rhodes, Chalcedon, the representative of Byzantium, Trapezus, and Issus being the centres respectively for the south-west, north-west, north-east, and south-east systems. Though sea coast towns, Ephesus, for instance, notably, and Amisus, are used in the triangulation, or inland towns, such as Melitene, they ultimately derive their position from one or other of the corners of the square. The independence of the

* The note will bring out, also, how great the difficulty often is in arriving at an absolutely correct estimate of the distance of one place from another.

systems is clear from several considerations. In the first place, map-distances and road-distances, measured from sites belonging to a given system to the centre appropriate to that system, are found to coincide. In the second, when similar measurements are made to a centre belonging to another system, no such correspondence can be traced. In the third, as we shall see, towns in the centre of the map are often either too close together or too far apart. It is interesting to note that in measurements from Trapezus, which pass through Satala, the distance between the two given by Marinus—60 m.p.—is retained. Ptolemy's censure applies only to the latitude assigned to Satala.* I was led to this conclusion by observing that the measurements, Trapezus to Nicopolis, Trapezus to Sebastia, etc., were, on any other condition, out by a uniform amount. A site once fixed was available for fixing the position of another site more in the interior or off a direct road from the coast. Thus the position of Philadelphia is fixed from Laodicea and from Ephesus, and itself affords one clue to the position of Dorylæum.†

It is towards the middle of the map that Ptolemy's method breaks down. On the one hand, the eastern and western systems tend to overlap, on the other the northern and the southern refuse to meet. The first is conspicuous in the case of Tavium and Ancyra, the second in the case of Tavium and Cæsarea. The position of Ancyra was fixed from the north and west,‡ that of Tavium from the north and east. In spite of Ptolemy's initial error, Chalcedon and Trapezus were still too close together to allow the windings of the roads to be ignored completely. Tavium and Ancyra, the border towns of the two systems, are therefore not far enough apart —not by a third of their proper distance. The road which joins them is, accordingly, represented on the map with exaggerated windings. The position of Cæsarea Mazaca, on the other hand, was fixed from south and east, and Ptolemy's method, neutralized to some extent by the fact that it pushed Tavium west as well as south, failed to catch the distance up. Tavium and Cæsarea should be about 100 miles apart: Ptolemy could not make them less than 170. The direct road which joins the two had therefore to be dropped; but a *détour* was available, which figures, more or less, in the Peutinger Table, and measures, according to that authority, 191 Roman miles.§ With the help of Ptolemy's map it appears

* 'Geographia,' lib. i. c. 15. The distance on Ptolemy's map is 83 English miles.

† The distance from Ephesus to Philadelphia is measured by Hypæpa and Sardes. It is interesting to note that the distance from Ephesus to Sardes *viâ* Smyrna agrees with the map-distance also measured *viâ* Smyrna, the map-distance from Ephesus to Smyrna being as much too great as the distance from Smyrna to Sardes is too small. This method of compensation is not without parallel in Ptolemy, and it had to be here no account of the course of the western coast.

‡ On the whole, I am inclined to think that Ancyra was fixed from Amorium, a secondary base, and Sinope, but distances are uncertain.

§ To Ptolemy, however, a road was chiefly a means of ascertaining the distance of one place from another; it was not, except incidentally, a means of journeying from place to place. It is, therefore, hardly right to say that the road is represented on the map, or that a *détour* was available. What, I imagine, Ptolemy did was this. Being in a difficulty, he fixed the position of some place accessible from both—perhaps it was Sarvena—from Tavium and Cæsarea by the help of its road-distances, not necessarily direct, from those places. This place and Tavium (or this place and Cæsarea) gave the clues to intermediate places, and kept them somewhere near the line joining the two. Where, on the other hand, there was compression—for instance, between Cyzicus and Nicæa, or between Ancyra and Tavium—it was convenient to measure from place to place along the road. Allowance, however, has to be made in such cases for Ptolemy's standard of accuracy, and for the consideration with which we deal in the next paragraph.

direct. Many of the towns mentioned in the table are scattered at appropriate distances about the line which joins the two.

Ptolemy's system of constructing his map by means of the intersection of circles gave two points for the position of each site. Between the two Ptolemy had to make his choice, and he was guided to make it by general considerations and by previous results. The point he did not choose, for instance, for Smyrna would be too far east; the point he did not choose for Nicopolis would be in the Euxine sea. These cases were straightforward, but even where our fuller knowledge shows him to be very wrong, his choice was never altogether inconsistent with the knowledge he possessed, and was required by the results he had already obtained. The district south-east of the Pisidian Antioch is from this point of view one of the greatest interest. Iconium, indeed, is approximately its right distance from Antioch, but while Lystra is north of the line joining the two instead of south, Vasada and Amblada, which should be nearly south of Antioch,* are placed relatively to that city, the one as much north of east as the other is south of west; Parlais, which probably should be at Beysheher, has been removed east of Iconium, and Misthium has been carried from the position now assigned to it to a distance from Pappa the same as now, but a little west of north instead of west of south. What has happened is, I venture to suggest, as follows: Antioch is, on Ptolemy's map, too far from the south coast; the western group of colonies, which depended on it, have therefore been carried east, so much so that Cremna is 8 or 9 miles east of the line joining Antioch and Side instead of about 40 miles west of it. They and the towns immediately east of them accordingly occupy the ground which from the latest results ought to have received Lystra, Vasada, and the other towns I have mentioned. These could not be also carried east—the towns of the south-eastern system, to which Iconium and probably Isaura belonged, prevented that—so they have been squeezed out between the two groups. Lystra has suffered least. It is still approximately its right distance from Pappa and Iconium, and the relative positions of the three would not be so very far out, if the southern point of intersection of the circles had determined its site, and still less, if the site of Pappa had been fixed from Iconium, instead of from Antioch. With regard to the other places, the geography of the locality is too uncertain to justify at present an attempt to discover Ptolemy's mode of dealing with them, but experiments with various centres of measurement—Vasada, for instance, is its right distance from Antioch—appear to promise with fuller knowledge results similar to those obtained with Lystra.

APPENDIX.

Tables of Distances and Authorities employed.

In this Appendix the following abbreviations have been used:—

M. = Charles Müller, 'Claudii Ptolemæi Geographia.'
H. G. = W. M. Ramsay, 'The Historical Geography of Asia Minor.'
C. B. = W. M. Ramsay, 'Cities and Bishoprics of Phrygia.'
F. = the French map of Asia Minor.
K. = H. Kiepert's map of Asia Minor.
St. = J. R. Sterrett, 'Wolfe Expedition,' and 'Epigraphical Journey in Asia Minor,' vols. 2 and 3 of the Journal of the American School at Athens.
P. = the Peutinger Table.

* Cf. Ramsay, "Pisidia and the Lycaonian Frontier," in the Annual of the British School of Athens, No. ix. I gladly take this opportunity of acknowledging the many obligations under which I am to Prof. Ramsay. Some of them will be clear from the note which follows, but the note cannot show but a very small proportion of them.

The handbooks referred to are either Murray's 'Handbook to Constantinople' or Murray's 'Handbook to Asia Minor.' The measurements were made on a map specially constructed. The size of the maps which accompany this article makes them unsuitable for such a purpose; they are, in fact, merely convenient means of indicating results obtained by other means. I shall be glad to receive any corrections, of the probable need of which I am most conscious, and to facilitate them I have given references, and endeavoured to indicate how I arrived at my results. It is, however, the general coherence and naturalness of the method here suggested which appealed to me. Until my results have been tested, it is premature to discuss the use which can be made of them; but it appeared to me, as I was engaged on this work, that, if they stand the test, Ptolemy's information would be available, more than heretofore, to fix or suggest the sites of towns and the courses of the roads. They might also increase, for the same purpose, the value of the Table and the Itineraries.

I. Measurements from Idymus.

	Map-distance.	Road-distance.
Idymus to Ephesus	87	84½
„ Smyrna	129	125 or 126
„ Adramyttium ...	221	224 or 225
„ Ilium	296	300
„ Cyzicus	304	300
„ Magnesia	73	72
„ Pergamus	190	189 or 190

Idymus to Tralles, 56 miles (M., p. 815, F. K.); Tralles to Ephesus, 28½ miles (H. G., p. 164); Ephesus to Smyrna, 40 or 41 miles (H. G., p. 165); Smyrna to Pergamus, 63 miles (H. G., p. 165); Pergamus to Adramyttium, 35 miles (H. G., p. 166, note, F.); Adramyttium to Ilium, 75 miles (H. G., p. 166, note, gives Adramyttium to Assos, 41 miles; F. gives 33 or 34 miles on; cf. Murray's Handbook (Asia Minor), p. 63, and Peutinger table); the French map gives a distance in a direct line of approximately 72 miles from Adramit to the ruins of Cyzicus; the direct distance from Bergamo is 100 miles in the Handbook.

II. Measurements from Ephesus.

	Map-distance.	Road-distance.
Ephesus to Laodicea-ad-Lycum ...	97	100
„ Apamea Cibotus ...	167	164
„ Antiochia Pisidiæ ...	225	225
„ Philadelphia (*viâ* Smyrna)	115	112
„ „ (*viâ* Hypæpa)	81	82
Perga to Laodicea	140	139
Laodicea to Philadelphia	46	45
Side to Antiochia	130	128
Philadelphia to Dorylæum	148	150

Ephesus to Laodicea and Apamea (C. B., pp. 748 and 170; cf. H. G., p. 164); Apamea to Antioch (St. map); Ephesus to Philadelphia (*viâ* Smyrna and Sardis, H. G., p. 167; *viâ* Hypæpa, *ib.*); Perga to Laodicea (C. B., p. 255); Side to Antiochia (St. map); Laodicea to Philadelphia (H. G., p. 167); Philadelphia to Dorylæum (H. G., p. 168).

III. MEASUREMENTS FROM CHALCEDON.

	Map-distance.	Road-distance.
Chalcedon to Nicæa	74	74
" Dorylæum ...	133	137
" Amorium ...	219 or 220	217
" Pessinus ...	239	235

The distance from Chalcedon to Nicæa was not measured by Nicomedia, but probably by the ferry at Cibotus. The distance given in Murray's Handbook (Constantinople) for this route corresponds very closely to the distance on the map, namely, Haidar Pacha to Dil Iskelesi, 34¼ miles; Ferry, 2 miles; Hersek to Isnik, fifteen hours, say 38 miles (cf. pp. 116, 132, and H. G., pp. 186, 188, and 240 ff.). Nicæa to Dorylæum, 63 miles (Peutinger, M., p. 804, R.G. map); Dorylæum to Tricomia, 42 miles (H. G., p. 239); Tricomia to Amorium, 38 or 39 miles (H. G. map); Amorium to Pessinus, 27 miles (H. G., p. 237); Dorylæum to Pessinus, 62 miles.

The distances to Ancyra are perplexing, and the problem cannot be settled without fuller information than I possess. It is worth while, however, to note that the distance from Amorium to Ancyra is on the map 100 miles, or within a mile or two of the correct road distance (H. G., p. 238). The map-distances from Chalcedon to Claudiopolis and Flaviopolis respectively also agree with the distances by road as given on Ramsay's map. I am inclined to think now that both Pessinus and Ancyra were fixed from Amorium.

IV. MEASUREMENTS FROM TRAPEZUS AND AMISUS.

	Map-distance.	Road-distance.
Trapezus to Nicopolis ...	112	110
" Neo-Cæsarea ...	169	170
" Comana Pontica	189	189
" Amasia	243	243
" Sebastia ...	185	185
" Tavium	320	324
Amisus to Amasia	64	60
" Neo-Cæsarea ...	123	133
" Nicopolis	188	185
" Comana Pontica ...	123	115

Trapezus to Satala, 54 miles (M., p. 41); Satala to Nicopolis, 56 miles (K. cf. H. G., map); Nicopolis to Neo-Cæsarea, say 60 miles (H. G. map, and Murray's Handbook of Asia Minor, map and pp. 44 ff.); Niksar to Koilu-hissar is 19 hours, say 50 miles, and it is about 10 miles on to Purkh; Neo-Cæsarea to Comana Pontica, 19 miles (H. G., p. 263); Nicopolis to Sebastia, 75 miles (M., p. 875); Neo-Cæsarea to Amasia, 73 miles (H. G., p. 263); Amasia to Tavium, 81 miles (H. G., p. 260); Amisus to Amasia is 24 hours, say 60 miles. Kiepert makes the distance from Amasia to Neo-Cæsarea less, and that to Comana more.

V. MEASUREMENTS FROM MELITENE.

	Map-distance.	Road-distance.
Melitene to Cæsarea Mazaca ...	198	200
" Comana Cappadociæ	153	155
" Archelais	275	272
" Samosata	115	115

The authorities for these statements are H. G., p. 273 (cf. Sterrett, 'Epigraphical Journey in Asia Minor,' p. 234 ff. and map), and C. B., p. 749; the distance from Melitene to Samosata is given in M., p. 892, as 115 miles.

The distance from Trapezus to Melitene corresponds approximately with the measurements on Kiepert's map—54 miles being allowed for the distance between Trapezus and Satala, and the route *viâ* Aziris being taken. The same is true of Zimara, but the geography of this part is very obscure.

VI. Measurements from Issus.

	Map-distance.	Road-distance.
Issus to Mopsuestia	29	33
" Adana	51	49
" Tarsus	77	75
" Mopsucrene	103	97
" Podyandus	133	121
" Cybistra	174	169
" Baratta	206	206
" Iconium	249	251
" Tyana	205	204

The earlier road-measurements agree with the itineraries as restored by Prof. Ramsay in the *Journal* for 1903, Part ii. p. 408. The distance between Podyandus onwards is given in H. G., p. 357, as 54 m.p. to Cybistra, 41 to Barata, and 50 to Iconium. Tyana is measured *viâ* Cybistra, from which it is distant 39 m.p. I think it most probable that Archelais, Sebastia, and Cæsarea Mazaca were fixed from Issus; but though the figures, such as I can get, agree approximately, I cannot get exact measurements of the road-distances. For the measurements from Laranda to Seleucia and Celendris, cf. H. G., p. 362. Mopsucrene may have been fixed from Issus; Podyandus was not. The resumption of conformity after they were passed is interesting, and we should not expect conformity in their case—they are intermediate places. The map-distance of Podyandus from Cybistra is 46 miles.

REVIEWS.

EUROPE.

British Trade.

'Wirtschaftsgeographische Studien aus Grossbritannien.' Von Stefan D. Popescu, Professor an der Handelshochschule zu Jassy. Leipzig: 1903.

In the summer of 1902 (May—August) the author made a journey to Great Britain, where he studied the navigation, shipping, and trade of this country with a view to the present study. In compiling the same, he has made especial use of the publications of the Board of Trade, such as the Annual Statements (1) of the navigation and shipping, and (2) of the external trade, of the United Kingdom. Four main divisions are adopted, in which the Bristol Channel, the Mersey, the Clyde, and the British coal-trade are successively chosen as the subjects of discussion; in relation to each, a mass of useful and instructive, if not very novel, statistics and observations are collected. The physiographical circumstance of the Bristol Channel, Mersey, and Clyde basins is the subject of particular attention; questions of local orography and hydrography, of meteorology, of tides and alluvial deposits, are discussed with some detail; and the historical development

of the local commerce is fairly well treated, though M. Popescu is content to quote reviews, guides, and handbooks for this part of his inquiry. English names and citations are generally accurate, but occasionally require revision, as is shown by "Cootswold," "Penin," "entrepriese" (pp. 23, 47, 82). The tabulated comparison of the coal output and trade of the chief coal-producing countries is one of the best features of the volume.

C. R. B.

ASIA.

Geography of India.

'India.' By Colonel Sir T. H. Holdich, K.C.M.G., K.C.I.E., C.B., R.E. Regions of the World Series. London: H. Frowde. [1904.] *Maps. Price 7s. 6d. net.*

In the now almost-forgotten pages of the 'Noctes Ambrosianæ' it is recorded how, when the eloquence of the rest of the company was found unequal to the occasion, a unanimous cry of "Describe, Shepherd, describe," never failed to elicit a satisfactory response. Had Sir T. Holdich been numbered amongst the elect of Maga, there is little doubt but that his fellows would have accepted his powers of description as an equivalent alternative to those of their Ettrick comrade. In the present work he sets himself down to treat descriptively the "infinite geographical variety" of the region we know as India, and well has he performed his task. He has enjoyed opportunities such as fall to the lot of few, even in the roving service to which his professional life has been chiefly devoted; and to the knowledge and experience of the trained observer he has added an artistic sense of proportion in both the selection of his points of view and the language in which he conducts his reader from the "sun-dried desolation" of the coast of the Arabian sea to the "terraced rice-fields" of Kun-Long, which looks across the river at China, or, again, from the mighty crags of the upper Indus to the golden sands and waving palm-groves of Ceylon.

In the technical treatment of his subject, a commendable feature is the compendious form in which the author has summarized the most recent conclusions regarding the main physiographic characteristics of India and its neighbourhood. Some of these conclusions are still, no doubt, conjectural, and likely to remain so, as, for instance, the southern limit of the now submerged Lemurian region, as it existed at the end of the Jurassic period; whilst others, such as the north-western limit of the Himalayan system, are matters of controversy. In regard to the latter, the author, whilst adopting the conventional view of geologists, that the system does not extend beyond the Indus, quotes, with apparently some degree of agreement, the other theory supported by the analogy of the passage of the Satlaj and Gandak, of the continuation of the system south of the Gilgit valley. On these great natural features of the north, and their more modern supporters on the south-west, the author dwells long and lovingly, as is only to be expected of one who for so many years toiled and travelled among them. He may, indeed, dwell upon them too long and with superabundant rapture to please those of his readers who belong to what Kipling, another sojourner in the north, contemptuously stigmatizes as the "Shigramitish" people, who traverse the tame plains of the peninsula in "shigrams," or vehicles drawn by bullocks, and are more than contented with an altitude of 3000 feet for their summer resorts. His justification lies, however, in the dominating influence these natural barriers have exercised upon the history of the country, and the leading part they play, and must continue to play, in its political destinies. In connection with this aspect of the tracts in question, the author wisely does not hesitate to overstep the political frontier of India, since the real frontier includes, as he indicates, both Afghanistan and Baluchistan, and, in

view of recent events, the west and south of Tibet may be added. It would have been a pity had the admirable chapters on the two first-named countries been omitted and the reader thus deprived of the lucid explanations given therein of the true bearings upon the security of India of the approaches to that country which lie within and along the territories of the Amir. The problem of the British army, said Mr. Balfour at Glasgow not long ago, is the problem of the defence of Afghanistan. That country alone offers the necessary "take off," so to speak, for a spring upon the open plains of the Panjab. In this work will be found a masterly exposition of the strength and weakness of these main lines of approach under modern conditions of transport, with a brief review of the use made of them in the invasions of the past. At the same time, it is inadvisable, in the existing circumstances, to concentrate attention on the north-west alone, and to exaggerate, as the writer seems somewhat inclined to do, the inaccessibility of India along its northern frontier. Difficulties hitherto deemed insuperable are giving way before the resources of modern engineering, and communication is established between countries which Nature apparently intended to keep for ever separate. Nipal, Bhutan, and Sikkim are "buffer states" only in name and in the sense in which that term was used, for example, in the first and abortive settlement of the Siamese question. They cannot be counted in the same line with Afghanistan. Beyond them lies a tract which, however inhospitable, affords ample room for political agitation and intrigue, a fact of which the smaller units just mentioned have showed themselves fully cognisant. Nipal remembers, probably, the passage of the Himalaya in 1792 by an invading army from China, which dictated terms to Khatmándu from the south side of Gaurishankar, whilst the ethnographic composition of the population of Assam and eastern Bengal, and the irruption of Shan tribes within historic times, indicate that in these directions, also, India is by no means invulnerable, though less open to attack than upon its western flank, which lies in the line of motion of the more warlike and ambitious elements of continental Asia.

In connection with the latter region, the author gives a very valuable account of the once much-frequented routes between India and Southern Persia, some of which have recently been resuscitated for traffic. For a long time past this tract has been almost ignored, and Sir T. Holdich is doing good service in welding into the geography of India a region with which our acquaintance has been lately much increased by surveys, by a revival of interest in the return journey of Alexander and his fleet, and still more, perhaps, by the growing attention which is being paid to the valuable record of Arab geographers. That race, as the author reminds us, always kept a keen eye on the Makrán routes, and as soon as they obtained command of the narrow sea, possessed themselves of them, and, under the protection of their vessels, perpetrated the only successful invasion of India from the west which took a route other than those of the Afghan passes. For the present, the interest in this remarkable tract has left the coast for the interior, and though it may not be reasonable to hope that a revival of Indo-Persian trade will restore its former prosperity to the country, substantial improvement may result from the protection of the roads, and the gradual establishment along them of local centres, introducing fresh blood, and attracting to settled occupations the sparse population of the surrounding "dasht." Reverting, for a moment, to what was said above as to the anxiety of the Arabs to secure maritime supremacy on the west coast of India, the far-sighted saying of Bacon may be remembered, that "the wealth of both Indies seems in great part but an accessary to the command of the seas." From the earliest days of Mediterranean civilization there was competition for the trade of India, and it is interesting to compare the conditions of former

intercourse with those of the present day, and to note the curious reversal of the course of merchandise which has resulted from the development of ocean traffic. When goods were conveyed by baggage-animals or small coasting craft, the exports from India consisted mainly of luxuries, such as gold, precious stones, spices, and rare fabrics of "woven dew," all representing high prices in small bulk. All, moreover, were the products of artisans working for the upper classes and probably bound to the *entourage* of a chieftain's court. Long sea traffic in vessels of large capacity has diverted the export trade from the city to the village. The cheap surplus produce of the peasant has taken the place of the costly superfluities of the rich, and manufactures have given way to raw material. On the other hand, luxuries, except gold and silver ornaments, pass from west to east, and from the clocks and carriages of the raja to the beads and turban of the ryot, all comes from Europe. India indents upon England for her finer fabrics, instead of providing them for us, and whilst we have naturalized here the term *calico*, derived, it is said, from an Indian port, the Indians have assimilated *manjar*-pat, a cotton fabric under more than suspicion of a *Manchester* origin. From an artistic standpoint this change of direction, the author emphatically pronounces, has little to commend it, for not only are exotic products introduced with the baleful air of (say) Birmingham floating round them, but many of the indigenous arts fall before "the patron and the gaol," in other words, before the globe-trotter, to use Tom Coryat's now classic phrase, and the prison-factory. The association, however, of art with religion, which, as Sir George Birdwood has shown, is in India indissoluble, has proved the safeguard of the domestic industries of the country, and in these, with better material and improved handiwork, the traditional purity of form and design remain intact.

In other respects, the British connection with India, reviewed by the author in his political chapter, is such as to bear out what the late Lord Derby—in 1858—declared it to be, a great glory, a great responsibility, and a great danger. Sir T. Holdich seems to be of opinion that in certain directions this connection might advantageously be drawn closer, as, for instance, through the colonization by British settlers of the vale of Kashmir. There are, however, two sides to that question, and it is doubtful if such a community would turn out to be a source, as he suggests, of strength to British rule. The climatic conditions are, probably, almost perfect, but they cover only a portion of the field. More important is the surrounding social and moral atmosphere, which must always remain that of a subject Oriental race. The colony would either be one of employers, or it would lose its racial prestige by competing with natives in every-day means of livelihood. The strength of the British administration lies in sympathetic aloofness, not in fusion of either race or individual interests. "Those who want to rule people," says Selden, "make themselves as different from them as possible. The stranger, by his very isolation, acquires a superiority." Social intimacy with the natives, as Sir T. Holdich points out in another passage, is neither desired by them nor desirable for the foreigner. In India, the caste system, on which the whole scheme of life is based, is so strongly assimilative that no ruling race which has once made its home in the country has been able to resist absorption, and thus losing its distinctive character and its independent existence. A change of creed or mode of life is not essential to this influence, but the environment tells upon the new-comer, and his most vital interests detach themselves from those of his race, with the centres of which he gradually loses touch. This is a factor in the Brahmanic system on which the author in his account of that form of religion seems to lay too little stress, as he speaks of "conversion" to Hinduism, when the process is really incorporation, or submersion. There are other points in his account of the people of India, especially as to "origins," which might be selected as showing both

that the subject itself was one requiring vast research, and that the author has not been able to make himself as familiar with the latest outcome of that investigation as he has been with the physiography of the country. One can say, indeed, of ethnography as the Irish lady said of scratching—once you begin, it's hard to stop!

J. A. B.

The Exploration of Further India.

'The Story of Exploration.' Edited by J. Scott Keltie. 'Further India.' By Hugh Clifford, C.M.G. London: Lawrence & Bullen. 1904. *Maps and Illustrations. Price 7s. 6d.*

Mr. Clifford is much to be envied the task which fell to him when called upon to write the story of exploration in Further India. To the general glamour of the East, with its barbaric pomp and more or less mysterious origins, is added in this case, as a further source of interest, the exuberance of the natural forces which oppose the hardy explorer in the jungles and river gorges of the great Eastern peninsula, while the unhackneyed nature of the subject—for to the general public even the main actors, such as Mendez Pinto or Francis Garnier, are somewhat shadowy personages—is another decided advantage. Mr. Clifford's literary experience has enabled him to weave a story of romantic interest from these favourable materials. While the great bulk of the book is devoted to the modern exploration, and of this again a preponderating part, no doubt of set purpose, to the Lagrée-Garnier expedition, the opening chapters give a brief but effective view of the main historical epochs, each marking a definite stage in the gradual unfolding of these Eastern regions to the Western world. The author's standpoint is throughout, in fact, more pronouncedly historical than geographical, and there is little definite attempt to sketch the broad geographical problems which awaited solution at successive epochs, and which, somewhat strangely, are most fully touched upon in the concluding chapter. This is, perhaps, due to the geographical restrictions by which the author seems to have felt himself bound, most of the questions involved, *e.g.* that of the source of the Irawadi, being equally the concern of neighbouring regions.

Among the many interesting questions connected with the early intercourse between this region and the West, or nearer East, Mr. Clifford deals with the possible location of the Biblical Ophir in the Malay peninsula (a theory towards which he seems favourably inclined); the explanation of the statements of Marinus and Ptolemy, and the identification of the latter's Catigara in Southern China; the opening of the regular sea-route round the Malay peninsula, with its development in course of time into a well-frequented track; followed by the voyages along it of Marco Polo and other mediæval travellers. Then comes the irruption of the Portuguese "filibusters," as they no doubt are rightly termed, and the establishment of Portuguese supremacy under the stern and pitiless energy of men like Alboquerque; the successful rivalry of the Dutch and English, and the development of their commercial undertakings; and, finally, the detailed story of modern exploration, centred, as before noted, in the personality of Francis Garnier and the exploration of the Mekong, but comprising abundant details on British activity further west, as represented in the work of Hannay, McLeod, Richardson, McCarthy, and others. A special chapter deals with the problem presented by the evidence of a former Khmer civilization in the ruins at Angkor Wat.

On a few points of detail Mr. Clifford falls into inaccuracies, showing him to be not quite at home in some of the outlying parts of his subject, while the researches of some former writers (Schlegel, Anderson, Gerini, etc.) seem to have escaped

him. Thus we miss any reference to recent discussions on localities mentioned by old travellers, such as the Dondin and Nicoveran of Oderic. A somewhat fuller treatment might have been accorded, perhaps, the early modern period, particularly the establishment of English trade with Siam; no mention being made of the voyage of the *Globe* under Hippon. But considerations of space no doubt stood in the way here. And any slight defects are fully compensated by the author's personal knowledge of the countries and peoples of which he writes, which enables him to impart a high degree of actuality to his narratives, the human interest of which is one of their prominent features. The book is excellently illustrated by maps and photographs.

Affairs of Asia.

'On the Outskirts of Empire in Asia.' By the Earl of Ronaldshay. Blackwood & Sons. 1904. Pp. xxii., 408. *With two Maps. Price* 21*s. net.*

This is a skilful compilation by a well-known Asiatic traveller. The map at the opening of the volume shows Lord Ronaldshay's journeys, which are here set forth, to extend from Constantinople to Tokio. The line leads by Konia, Aleppo, and Mosul to Bagdad, thence to Teheran, to Resht and Baku, across the Caspian, to Merv and Bokhara. From his route, thence north-eastward, the author turns aside twice, into the Tian Shan, and into the district of the Lesser Altai. Thereafter he joins the railway, travels by it to Port Arthur, and visits Pekin and Wei-hai-wei, besides Japan. Truly a comprehensive course, well fitting the author for his ultimate task in the present volume, which is to set forth in sectional analysis the large political problems of the East, both Near, Middle, and Far. But the book is by no means a political treatise only. Lord Ronaldshay affords his readers a geographical groundwork by describing his travels at length, and makes full use of his power of clear narrative; in fact, the descriptive part of the book is considerably the larger. A short section of the book (three chapters) is devoted to sport, in successful search of which the author paid his visits to the Tian Shan and the Siberian Altai. A book of this sort, of course, contains no scientific or specialized matter, but as regards general information, Lord Ronaldshay writes almost encyclopædically. Consequently, the student of Asiatic affairs need not go beyond this book for a groundwork in his subject, and will have the advantage of finding his information in an excellent geographical setting. There are good photographs, and, besides the general map, one of Asiatic Turkey having particular concern with the Bagdad railway, to which the author devotes an interesting chapter.

AFRICA.

African Races.

'Recherches anthropologiques dans l'Afrique orientale: Égypte.' Par Ernest Chantre. 4°. xviii., 318. *Illustrated.* Lyons: Rey. 1904.

The author, who has been occupied for a long time with Egyptian skull-forms, here puts forth, in a magnificent volume, a general survey of the results attained by himself in the special studies which he made on the spot between 1898 and 1904, combined with the records and observations of other anthropologists. He begins from the earliest times, the Stone Age, of which many relics were found by various explorers between 1868 and 1894; but he hardly gives credit where credit is due. For unquestionably it was Prof. Petrie's discovery of his "New Race" cemetery near Nagada, in 1895, which first brought these isolated observations into mutual relation and prominence. That explorer certainly was the first to give the

craniologists any material for a study of this period. M. Chantre passes on to the Metal Age, and so into historic times, dealing with the physical characteristics of the ancient and mediæval Egyptians from mummies, paintings, and statues. The second half of the volume is concerned with the modern inhabitants: first, the Fellahin; second, the bedawins; thirdly, the Nubians; lastly, the inhabitants of the eastern Sudan. The author was allowed by the local authorities to study the soldiery of various races, and he was diligent in collecting types among the civilian population. The photographs are excellent, and admirably reproduced. The chief fault which a cursory inspection of the volume reveals is one to which many Frenchmen of science are prone, namely, excessive length caused by elaborate exposition of many things which have been fully dealt with by earlier writers. For instance, what is less necessary in a book of this kind than discussions on ancient Egyptian beliefs in regard to the dead, or on the whole art of mummification? In lecturing it is well to assume next to no knowledge in the audience, which has no opportunity for reference to other authorities; but it is needless in writing books. We have nothing else, however, to complain of in a volume distinguished as much by thoroughness and accuracy as by its truly admirable typography and illustration.

The Masai.

'Die Masai; Ethnographische Monographie eines ostafrikanischen Semitenvolkes.' By M. Merker. 6 *Plates*, 150 *Illustrations in the Text, and Sketch map*; xvi. + 420 pp. Berlin. 1904. *Price* 8 *marks*.

During a residence of some seven years in German East Africa, Captain Merker found time amid his official duties to collect a great mass of anthropological data amongst the Wandorobo, the Wakwafi, and especially the Masai inhabitants of that region. His observations, all made at first hand, are embodied in this handsomely furnished volume, which thus forms a welcome supplement to the late Joseph Thomson's 'Through Masailand,' which, although not mentioned and apparently unknown to the German writer, covers much of the same ground, and still remains our chief authority on the remarkable social and political institutions and military organization of the Masai nomads. About half of the present work is occupied with these and other ethnographic matters, which are disposed in three sections, and treated in almost exhaustive detail, with a clearness and thoroughness that leave nothing to be desired, while the numerous illustrations of types, implements, costumes, dwellings, and the like, partly from drawings and partly from photographs, maintain the high repute deservedly enjoyed by German typographic art for such reproductions.

But, owing to its startling novelty, most readers will perhaps be attracted in the first instance to the fourth section, in which the author elaborates his strange and strained views on the Semitic origin of the three above-mentioned ethnical groups. These represent three successive waves of migration from North Arabia, where before the dispersion they had long dwelt together with the kindred Israelitish people, from whom they separated at some remote epoch, but apparently between 5000 and 4000 B.C., and made their way by the isthmus of Suez and down the west side of the Red sea to their present domain in the Masai steppe lands east of Lake Victoria Nyanza.

It should be at once stated that this singular assumption is entirely based on the national traditions, myths, legends, and religious observances of the Masai people, which Captain Merker has collected with rare diligence, and which are here for the first time given to the public. That they present astonishing and most unexpected coincidences and parallelisms with the corresponding features of early

Jewish social and religious life cannot be gainsaid, so much so that one may venture to say that henceforth Masai folklore can no longer be neglected by the "higher critics." But that they lend support to the author's prehistoric migration theories will be believed by nobody so long as the resemblances admit of a less extravagant explanation. Nor are these theories at all strengthened, but rather upset, by the wild etymologies somewhat inconsiderately brought to their aid. Thus the mythical *El dinet* people are the Hittites, and they dwelt long beside the *El eberet*, *i.e.* the Hebrews, sprung from the Biblical *Eber*, while the El dinet god *Nyau* is the Masai god *Ngai*, and the Hebrew *Yahveh*, the Assyrian form of which is *Yau*, this being the old Masai word *hau* = "great." All this is confirmed by the first of the ten Masai commandments: "There is one only God. Heretofore you called Him . . . *E'magelani* ('Almighty'); henceforth you shall call Him Ngai," as in Exod. vi., where the "Almighty" (*Shaddai*) is similarly replaced by Jahveh. But this was in the Exodus period, say 1500 B.C., or about 3000 years after the Masai migrations (see above), so that the reference, instead of confirming, destroys the whole scheme. The same remark applies to the other "identities," as they are called, such as *Abel* = the Masai *Nabe*; *Abraham* = *Narabá*, both being rich in cattle, and marrying in their old age; *Moses* = *Musana*; *Tubal-Cain* = *el konono*, where Tubal is the Somali *tumal*, and the Galla *tumtu*, both meaning "smith," while *Cain* is the *Cainan* of Gen. v. 9, which, like the Masai *el kono*, also means "smith," so that *Tubal-Cain* = "smith-smith." In all these equations the chronological difficulty is acutely felt, but is met by the suggestion that the myths and associated names are pre-Biblical, "eine gemeinsame Uranschauung," that is to say, the common property of the proto-Babylonians, proto-Israelites, and proto-Masai, which, after the dispersion, was carried away by them, and further developed independently in their later settlements—Mesopotamia, Palestine, Masailand. But the languages of these peoples are radically distinct, and if they were able to carry away and preserve such a body of their common folklore, it will be asked why they failed to preserve something of their common speech. Captain Merker's assumption presents many other most formidable difficulties, which are not found in the more obvious view that the Masai derived their scriptural legends and practices from contact with the Judaizing Falashes of the neigbouring Abyssinian uplands.

Besides a sketch-map, showing the full extent of the Masai domain, there are six plates, giving the designs depicted on the different tribal shields, the "coats-of-arms" of the various septs, and the brands of ownership on the bodies and ears of the cattle and on the warriors' spear-heads.

A. H. KEANE.

AZURARA'S CHRONICLE.

'Les Manuscrits de la "Chronica do descobrimento e conquista da Guine" par Gomes Eannes de Azurara, et les sources de João de Barros.' By Jules Mees. Lisbon (Bibliotheca da Revista Portugueza Colonial e Maritima).

In this valuable pamphlet, disfigured by many bad misprints, Dr. Mees describes (1) a manuscript in the Munich Library [Cod. Hist. (Lusit.) 102] which once belonged to the orientalist Quatremere, and was purchased, with the rest of that savant's library, by Maximilian II., King of Bavaria, in 1859; (2) a manuscript in the Madrid National Library, numbered 2424; (3) a manuscript in the Munich Library, in the Collection of "Valentin Fernandez Alemão," and in a volume once belonging to Conrad Peutinger, and entitled by him 'De insulis et peregrinatione Lusitanorum.' The first and second of these are simply copies of the Paris Manuscript of Azurara, which has been printed by Santarem

and translated in the Hakluyt Society's version of the 'Chronicle of Guinea.' The third is derived from the same source, but in a less simple manner. It is not a full copy, but a much shortened form. The 97 chapters of the Paris text are here reduced to 61; chapters 5–7, 28, 49–50, 66, and 97 are wholly omitted; whole groups of other chapters are rolled into one—thus 37–48, 51–9, 68–9, 72–4, together amount to four only in Valentin Fernandez' recension. The copyist was apparently in a desperate hurry to finish his work, and makes short work of many of the reflections with which Azurara loads his chronicle, though adding a couple of allusions to the voyages of Cadamosto (see folios 215, recto, 260, verso, of the Fernandez manuscript). As to the great Paris manuscript, Dr. Mees seems inclined to believe the tradition of Fr. Luiz de Souza, according to which the Infant D. Henry presented this copy to the King of Naples in 1457. He also suggests that the 'Chronicle of Guinea' in this form was used by Las Casas in his 'Historia de las Indias.' From a note on fol. 161, recto, it is clear that the manuscript in question remained in Spain as late as 1702; Luiz dé Souza appears to have seen it at Valencia many years earlier (see 'Historia de S. Domingos,' p. 332, edition of 1623).

Dr. Mees concludes with an interesting comparison of certain passages of Azurara's *Guinea* with corresponding parts of Barros and Pacheco Pereira's *Esmeraldo*. The parallel between the last-named and the narrative of Gomes Eannes in the matter of the first rounding of Cape Bojador is very striking, especially as Pereira nowhere acknowledges any obligation to Prince Henry's panegyrist (*cf.* 'Esmeraldo de situ Orbis,' p. 39, edition of 1892; 'Chronica de Guiné,' p. 57, edition of 1841). Barros, on the contrary, frankly acknowledges that Azurara's *Guinea* is the chief source of his narrative for the events of Prince Henry's life, though for Madeira he also employs certain records in the possession of the heirs of João Gonsalvez Zarco, the principal leader in the Portuguese discovery of that island. It is not, therefore, surprising to find that he makes some use of nearly every part of Azurara's African chronicle, only passing entirely over the matter of some 23 chapters out of 97 (viz. chs. 1–3, 6–7, 24–5, 28, 49–50, 61–2, 70, 78, 84–5, 89–92, 95–7). C. R. B.

History of Madagascar.

'Collection des Ouvrages anciens concernant Madagascar.' Vols. i. and ii. Paris: Comité de Madagascar. 1903–4. Pp. 527, 559.

This valuable series of *Fontes* for the history of the great African island, under the general direction of the veteran Alfred Grandidier and three colleagues, opens with a volume containing all those passages relating to Madagascar which are to be found in French, English, Dutch, German, Portuguese, Spanish, Italian, and Latin works between 1500 and 1613. The second volume continues the 'ouvrages ou extraits d'ouvrages relatifs à Madagascar,' from 1613 to 1640. Thus far, we have over a thousand pages of material for the history of the "Island of the Moon," and the whole undertaking is to comprise four times as much—ten volumes in all, with an average of from 450 to 550 pages, furnishing a complete collection of description and reference, in all languages, and by men of every nation, down to 1800. The material printed appears to include every passage of importance necessary to illustrate European dealings with Madagascar, together with the history and manners of the native races from the end of the fifteenth to the end of the eighteenth century. Sufficient explanation and emendation is furnished for the thorough understanding of the texts. Unpublished manuscript sources have been consulted, early maps have been abundantly reproduced; and everything has been done to "erect," in the editors' words, "a monument not less valuable than the

sculpture of Barrias," unveiled at Tananarivo in 1901. Alfred and Guillaume Grandidier have given in these volumes a fresh and striking proof of French interest in the great insular possession which has been a subject of intermittent national ambition at least since the days of Richelieu, and whose acquisition in our own time is a proof of the persistency and success with which France has worked towards some at least of her "traditional aspirations."

In one point I should like to express a certain dissent from M. Alfred Grandidier. He denies that Marco Polo has any knowledge of Madagascar or any intention of referring to that country; he therefore excludes Polo from his collection of sources, and makes the Portuguese Covilham the first to name Madagascar to Europeans—"Contrairement à l'opinion generale, le pays que Marco Polo a nommé tantôt Madagascar tantôt Mogelasio . . . n'est certainement pas l'île à laquelle nous donnons aujourd'hui ce nom . . . Polo n'ayant pas eu connaissance de l'île que nous nommons Madagascar . . . Première mention de Madagascar en Europe par Pierre de Covilham, en 1489" (pp. ix., x., 1). I do not question that in Messer Marco's sketch of *Madeigascar* there is an evident mixture of genuine and spurious particulars, the latter perhaps referring to the region of Makdashau, Mogdicho, or Magadoxo, and other Arab colonies of the Somali coast; but I think there is a good deal more to be said. First, the *name* is undoubtedly in Polo. Thus in the oldest text, that of the Paris manuscript (1116 Fr., in the Bibliothèque National, printed by the Paris Geographical Society in 1824), I cannot find any *Mogelasio*, nothing but *Madeigascar* (see *Recueil de Voyages*, etc., tome i., 1824, pp. 232–4). In M. Pauthier's text, the next in importance, it is always *Madeisgascar* (Pauthier, 1865, pp. 676–9). In the primitive Latin, printed by the Paris Geographical Society in the same volume with the fundamental French text, it is *Madagastar* or *Madagascar* (*Recueil*, etc., as above, p. 469); in Ramusio, it is *Magastar* (R., II., 57 F.—58 B., edition of 1583). Where is the authority for *Mogelasio* in the 'Livre des Diversités' of the Old Venetian? And why should the form of *Madagascar*, in any case, be considered a corruption of *Mogdicho?* Why should it not rather be a word meaning "Land of the Malagash," as M. G. Ferrand has suggested ('Les Musulmans à Madagascar.' Paris, 1893)?

And secondly, as to the thing; *Madeigascar* is truly described by Marco Polo as one of the greatest and noblest of islands, is placed by him with fair accuracy "about a thousand miles" south of *Scotra*, or Socotra, and is estimated without extravagant error as about 4000 miles in circuit. His Madagascar fauna is mostly absurd, and his statement that the people as a whole "adored Maomet" sounds at first little better; yet undeniable evidence has been found of Arab colonization at various points of the coast, especially in the extreme north-west and at several places on the eastern seaboard. Even the boars' teeth of Polo's narrative, which, according to the Italian traveller, were carried to Kublai Khan as curiosities, and which weighed more than 14 lbs. a piece, though possibly to be identified with hippopotamus ivory from the mainland, derive some support from the ancient name of *Nossi-Dambo*, or "wild-boar island," now long fallen into disuse.

Lastly, as to Marco's language about the currents which here set southward with such force that no one, if he passed beyond Madagascar, could return against them (*Recueil*, p. 233), can we say that this suits the Somali coast and Magadoxo so well as the Mozambique channel and Cape Corrientes? From the latter "runs southward along the coast the permanent Lagullas current, and Polo's statement requires but little correction" (Yule-Cordier, 'Marco Polo,' ii., 415).

C. R. B.

AUSTRALASIA AND PACIFIC ISLANDS.

Fiji Folk-lore.

'Tales from Old Fiji.' By Lorimer Fison. London: A. Moring, Ltd., The De La More Press. Pp. i.–xlv., 1–175. 22 *Illustrations and a Map.*

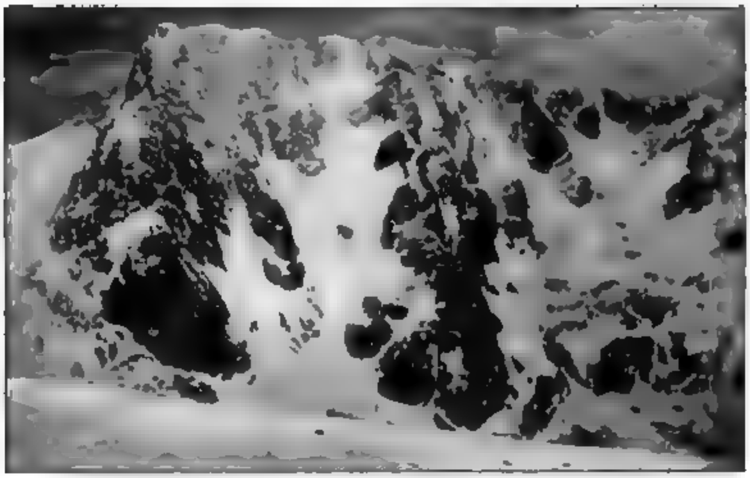
Folk-tales obtained from reliable sources and told in a pleasing manner, as are these, have both a literary and a scientific value, and from both points of view the old Fijian tales told by Mr. Fison deserve to be widely read. A large number of interesting ethnological data will be found embedded in the tales as well as in the introduction and appendix. In the introduction will be found notes of various words that in one sense have a harmless significance, but which are employed to convey a sinister or evil meaning. Among the Windward islands of Fiji two sorts of turtle were spoken of, "short turtle" and "long turtle." Of these the former referred to the real turtle, but the latter to the dead body of a man which was to be eaten. Among the Leeward islands a like distinction prevailed, pig being substituted for turtle. There is also a long discussion on the origin of cannibalism. Mr. Fison holds that in former days the Fijians were scantily supplied with animal food, and as they were subject to that insatiable craving for animal food which an exclusively vegetable diet produces, they betook themselves to human meat. It was hunger, and not superstition or revenge, which led to cannibalism. Most of the dozen tales are interesting as stories quite apart from the psychological or ethnological data they contain; some are myths of origin, others account for the migrations of peoples, or narrate the deeds of doughty chiefs; one tells of the untimely death of a lad who was the offspring of the sun and a beautiful human girl. One boastful tale states that "Napoleoni was a son of Tonga, for his mother came to us in a ship from the land of Merikei. She was a young woman, tall and fine; and after a while she sailed again to her own land, where she brought forth a child, though no man had her to wife, and this child she called Napoleoni. Now, after many days, when he was grown, the men of Faranise sent ambassadors to Merikei, begging for help against Uelingtoni. . . . So he led the men of Faranise. I could tell you of his mighty deeds—how he smote the enemies of Faranise, though they were many and strong; how he chased Uelingtoni from land to land till he caught him at Uatalu, and banished him to a desert island, where he died."

THE MONTHLY RECORD.

EUROPE.

Is there a Glacier on Ben Nevis?—In the March number of *Symons's Meteorological Magazine* this question is answered in the affirmative by the Rev. R. P. Dansey, who points out that there is one especial feature which favours the accumulation and duration of snow on Ben Nevis not to be found in nearly such a marked degree on any other Scottish mountain. The summit plateau, which rises steeply from the south-west—the Glen Nevis side—terminates, after forming the summit crest, in a magnificent series of precipices, nearly 2 miles in length, overlooking the north-east face. At the bottom of these precipices runs the small stream of the Allt-a-Mhuilinn, whence the corrie takes its name (see the photograph here reproduced). On the other side of this rise again the steep scree-covered slopes of Carn Mor Dearg, 4012 feet, which at the head of this great corrie joins Ben Nevis on the east by an arête which never falls below 3478 feet. The

corrie is enclosed on all sides except the north by very high ground. These grand cliffs, however, their 2 miles of length seamed by buttress, ridge, and gulley, not only keep off the sun, but they also intercept the warm Atlantic winds which blow over the top and on to the slopes of the opposite mountain, Carn Mor Dearg, leaving the snow-covered corrie in a cold atmosphere of its own making. By far the greater part of the snow that falls on Ben Nevis with all winds from south by west to west-north-west—which are the prevailing winds, and bring the heaviest snowfalls—is swept off over the precipices, where it accumulates in the great hollows and gullies underneath, in the Allt-a-Mhuilinn corrie. The maximum depth on the summit is generally reached about the end of April or some time in



CORRIE OF ALLT-A-MHUILINN, BEN NEVIS, SHOWING SITE OF GLACIER AT END OF APRIL.

May. The snow usually disappears from the summit about the beginning of July, except drifts, but the much greater accumulation below still remains. The minimum depth of snow under the precipices is usually found at the beginning of September. The Rev. A. E. Robertson says of these accumulations of compacted snow, "If you were to examine into it, I am sure you would find them practically ice, say after 12 or 24 inches below the surface, and I think also they would show glacial movement as well, so if that makes a glacier, then I think you have it on Ben Nevis." They have never been quite melted away within living memory, so no one knows what is below, or how much is below. Mr. Robertson crossed the largest "glacier" between the Observatory Ridge and the N.E. Buttress (climbers' names for routes up the precipices) in August last, and said the length of the "glacier" from top to bottom was then 300 feet; that it was of an average breadth of 50 yards, hard as a board, ribbed just like *névé* in the Alps, and that it would not melt much more, if at all, that year. In many places at its side he could look over into the bergschrund between the rocks and the snow, and could see down a great way, in many places 50 feet; so Mr. Robertson concluded that if it was 50 feet at the sides, it must have been much more in the middle. The rocks near it were heavily glaciated and rounded off. Mr. Robertson, who has a knowledge of all the mountains over 3000 feet high in Scotland, says that it is on Ben Nevis only that even a semi-glacier exists, and

that the snow-beds in the Cairngorms are much more open, and therefore more liable to be practically melted away in a hot summer. The level of the Ben Nevis "glacier" would be about 3000 feet, part of it higher, and part, perhaps, lower. The corrie of the Allt-a-Mhuilinn is probably the wettest spot in Great Britain; if a rain-gauge were placed, as Mr. Gethin Jones recently suggested in *Symons's Meteorological Magazine*, half a mile on the lee side of the summit of Ben Nevis, that is the side opposite to that on to which the prevailing rain-bearing winds blow, this corrie would be the spot. But the difficulties attending its reading would be very great, especially from October to June, when the corrie is often full of drift snow; and on the advent of warmer weather, avalanches, due chiefly to the giving way of the cornices on the cliffs above, crash right down into the centre of the corrie.

The Simplon Tunnel.—The last remaining barrier dividing the galleries driven from the north and south ends of this tunnel was pierced in February last. In spite of the difficulties and delays by which the undertaking has been beset, the allignment had been accurately maintained, and the junction was effected in accordance with the calculations of the engineers. Among the chief difficulties encountered was the amount of underground water to be dealt with, and the great heat experienced. We hope to recur to the subject of the tunnel, as it affects the main lines of international communication in Central and Western Europe.

A New Stalactite Cave near Triest.—Herr G. A. Verko, leader of the Grotto Section of the Triest Touring Club, has discovered at Markovsina, near Triest, a cave of great extent. With its many spacious halls full of the most beautiful stalactites, it far surpasses in grandeur all other grottoes of the Karst known down to the present time. The most interesting item in the discovery is a great subterranean watercourse running the whole length of the principal cavern. Two perpendicular chasms, one 115, the other 72 feet deep, lead into the interior of the cavern. Some blind troglodyte animals, including several quite new species, were found. Below a third passage into the cavern, at present completely blocked in consequence of an infall, there lies a rich deposit of fossil remains of animals dating from the Ice age. Even at the first exploration of the cave many parallel caverns were found, and numerous side passages containing fine groups of large sinter formations of all colours.

The Distribution of Population in Sweden in Relation to Geological Formations.—Hr. Per Stolpe has compared the density of population with the geological deposits, and finds that there is a marked connection between them (*Ymer*, Häft 3, 1904). Other factors have, no doubt, contributed to the present distribution. One of these is the climate, but its effect is not nearly so great as might be expected. In some points, also, concentration of population may be caused by the lumber and iron industries. But on the whole the influence of geological conditions is apparent—the limit of marine deposits, the occurrence of calcareous soil, and the configuration of the surface. As Prof. Högbom has noticed in Northern Sweden (vol. 21, p. 75), calcareous soils derived from the Silurian formation are especially fruitful. It has also been remarked that the vegetation is more luxuriant over the latest eruptive rocks, basalt and rhyolite, than in the surrounding districts.

Notes on Iceland.—The expedition referred to in vol. 22, p. 326, has returned to Denmark, having surveyed about 450 square miles of the most difficult country in the island. The Hvannadalsnukr, in the Vatna-jökul, the highest point in Iceland, was found to have a height of 6955 feet, whereas the former triangulation gave only 6427 feet. In another paper in the *Geografisk Tidskrift*, Bol. 17, Hefte viii., Prof. Prytz speaks of arboreal vegetation in Iceland. There is evidence that the island was originally covered with wood from the shore to the

mountains, and probably the forests were composed of birch, willow, and mountain ash, which are still found in small copses, especially the first. The inhabitants have cleared the wood to provide pasture land, and have used it to make charcoal and to roof their houses. The further the trees are from the villages the larger their growth. Captain Carl Ryder, in 1898, was the first to propose the re-afforestation of the island, and now an arboricultural society in Reykjavik is laying out plantations, and the agricultural society of Iceland is promoting the establishment of arboricultural societies throughout the country. Dr. Thoroddsen discusses in *Ymer*, Häft 4, 1904, the question of a post-glacial land connection between Iceland and the Færöes, which has been assumed by botanists to account for the vegetation of the island. At the beginning of the Miocene period land certainly extended over the Atlantic from Scotland across the Færöes and Iceland to the east coast of Greenland, but subsequently sank, and the island, much larger at the beginning of the Pliocene, gradually sank, and its present hydrographic system was formed. The dolerite streams ejected at the end of the period simply adapted themselves to the valley system already developed. The hypothesis of a post-glacial land connection involves an elevation of about 380 fathoms, which would have turned the North sea and Baltic into dry land. It may, however, be maintained that Iceland and the submarine ridge rose, while other areas remained undisturbed, but the absence of reptiles, batrachians, and all the higher mammals is opposed to this view, which, moreover, is unsupported by geological evidence.

ASIA.

Physical History of the Kishon and Jordan Valleys.—Prof. Bonney gives a note in the *Geological Magazine* for December, 1904, on the mode of origin of the present features of the Kishon valley and adjoining districts in Palestine, which presents a somewhat difficult problem. A broad trench, he points out, has been cut in the limestone highlands of Palestine to a depth of 1000 feet, and is now occupied by the plains of Acre and Esdraelon, the latter branching eastward into two arms, separated by Jebel Duhy or little Hermon, but maintaining their trench-like form, and cutting through the limestone isthmus which must once have united Samaria and Galilee. This trench is obviously a river-valley, but it is on much too large a scale to have been excavated by the present Kishon system. Such a task seems to necessitate not only a heavier rainfall, but also a much larger drainage area than now exists. The trench is obviously a beheaded valley, the two streams which descend to the Jordan on either side of Jebel Duhy having trespassed westward owing to their more rapid fall, and pushed the watershed in that direction. Thus, in Prof. Bonney's opinion, the Kishon valley is older than that of the Jordan, and still retains its ancient character to the west of the passes. The original stream must have been little less important than the Jordan itself, and its watershed would seem to have lain far to the east on the Syrian highlands. The movement by which these were first raised would thus have culminated in an axis still indicated by the headwaters of the Jarmuk, Zerka, and other streams, which formerly made their ways, by a limited number of outlets, westwards to the Mediterranean. Prof. Bonney also discusses the origin of the Jordan valley, to which he considers the term "rift-valley" to be inappropriate, and substitutes the more suitable term "trough valley." * He holds to the view that the watershed

* When the evidences of fracture are more obvious in the valley-sides, as in East Africa, he would be more ready to allow the term "rift-valley" to stand, and here, it is to be feared, it has become too firmly established to make way for a term that would be less liable to misconception. The origin of the word is often ascribed to Prof. Gregory, but we believe that that writer adopted a term already in use locally.

between the Dead sea and the Gulf of Akabah is not an original feature, but that a connection between the two did exist formerly.

Peter I. Range, Russian Central Asia.—The latest number of the *Izvestia* of the Russian Geographical Society (1904, 1 and 2), which is only just now out, contains an article by Lieut.-Colonel Novitskiy about his exploration of the Peter I. range. An immense area, thickly covered with snow-fields and glaciers, was discovered in this range in its eastern part, between the Muk-su and the upper course of the Khingu. It is beautifully seen from the top of the Gardanikaftan pass (12,800 feet high), and was explored by one of the members of the Lipskiy expedition. The main result of these explorations and the extensive survey which was made is to fully establish the fact that the Peter I. range is a south-western continuation of the Trans-Alai range, and represents, like this last, the border range of the great Central Asian plateau.

Northern Tobolsk.—The same number of the *Izvestia* contains an elaborate sketch of the northern parts of the government of Tobolsk and its inhabitants by A. A. Dunin-Gorkavich, who has spent thirteen years in this part of Western Siberia. This territory, which covers 367,300 square miles, continues to be represented on our maps as a blank, or as an immense marsh. It now appears, from a map of this region, on a scale of 1 : 680,000, which is given by the author, that a wide plateau, which rises about 100 feet or more above the general level of the land, covers the space between the Ob and the Irtysh; the remainder is occupied by tundras in the north, and forests elsewhere—marshy in the lower parts, and dry on the above-mentioned plateau. The population of this wide territory is only 35,000 souls, consisting chiefly of Ostyaks—who occupy, together with Voguls, the woody parts of the region—Samoyedes in the far north; a few Zyrians; and some Russians settled along the courses of the rivers. We find in the same number papers on the water reservoirs of the upper Volga, by I. V. Bushmakin; on pendulum observations in the Urals, by D. I. Dubyago; and on astronomical work in the same region, by B. Savelieff.

France and Siam.—The treaty between France and Siam, which has been the subject of so much discussion during the past three years, was at last ratified in its amended form at the close of last year. It will be remembered that a first treaty was signed in October, 1902, but that the outcry raised against its provisions by the French colonial party was such that it was withdrawn by the French government without being presented for ratification. A new treaty was negotiated, and this was signed on February 13, 1904, its general provisions being noted in the *Journal* for the following May (vol. 23, p. 684). On June 29, 1904, a further convention was signed, by which the original treaty was once more modified in certain directions. The most important provision is that by which the frontier between the Tonle Sap (great lake) and the Gulf of Siam is laid down. The line follows a number of small rivers and, finally, a chain of mountains running down to the sea at Cape Lem-ling, the result being to supply a natural frontier, and to give to France the port of Krat and the adjoining territory on the south. Another provision of the supplementary convention rectifies the frontier of the protected state of Luang Prabang, to which Siam makes over small areas both in the south and north. The terms of this convention are printed at length in the *Rèvue Française* for January, 1905. The territory yielded up by Siam to France in the Krat district was formally handed over during the last days of 1904, and eight days later the Siamese territory of Chantabon, which has been occupied by way of pledge during the whole course of the dispute between the two countries, was evacuated by the French troops. A commission for the demarcation of the boundary on the spot has already commenced operations in the Krat region, the

head of the French party being Commandant Bernard. The frontier in the Bassac region will be fixed later on, after the conclusion of the summer and autumn rainy season.

Korea in Early Maps.—M. A. Pawlowski has attempted to sketch the history of the cartography of Korea in a paper printed in the *Bulletin* of the Rochefort Geographical Society (1904, No. 3). The sketch is far from complete, and is marred by some inaccuracies, but a few points of interest may be noted. It is somewhat singular that many of the earliest maps of the extreme east of Asia show a peninsula in this region, though M. Pawlowski makes a very doubtful assumption when he regards this as possibly representing Korea. The first vague indication of such a peninsula might, in fact, be traced back to the map of Martellus Germanus (about 1489), to which he makes no allusion. The more pronounced form which it takes in the 1511 map of Bernardus Sylvanus, and its still greater development in the "Nordenskiöld gores" (to which also no reference is made) and Bordone's rough map of 1528,* can likewise be hardly the result of definite knowledge. During the middle of the sixteenth century the knowledge of this region continued exceedingly vague, and the 1570 "Theatrum" of Ortelius (unaccountably ascribed to Mercator in the article) gave no indication of the Korean peninsula, while Mercator gave the name to an island. M. Pawlowski ascribes the first definite advance to Linschoten, whose map, he says, shows the first proper appreciation of the general form of Korea, though still leaving the question of its connection with the continent undecided. It is not quite clear in what direction Linschoten's map shows much advance on that of Mercator, or on that of 1595, issued with the later editions of Ortelius, the materials for all these having evidently been much the same. The 1595 map, which embodies the information collected down to that time by the Portuguese, was the work of "Ludoico Teisera." One of the first maps to show Korea correctly as a peninsula was the Hakluyt map of 1600, but the old delineation as an island was adhered to in Holland and elsewhere until some time later. In later times a great improvement was due to the information sent home by the French Jesuits, and published by D'Anville, to which, however, M. Pawlowski devotes little attention, while giving full credit to the contribution of Strahlenberg, in his large map of 1730. The work of La Pérouse, Broughton, and Krusenstern brings us down practically to modern times.

AFRICA.

The Alexander-Gosling Expedition. — We have received further news of this expedition, dated "Kadde, Lake Chad, December 27, 1904" (cf. *Journal*, vol. 24, p. 589; vol. 25, p. 176). The sad death of Captain Claude Alexander, which had naturally cast a gloom over the whole expedition, had occurred on November 13, at Maifone, whither he had been taken on falling ill with enteric fever. The case had been hopeless from the first. The survey party under his charge had had some hard times owing to the rainy season, difficulties of transport, and scarcity of food, but no efforts were spared to carry out the mapping operations in the best way possible. Eventually the survey was continued under favourable circumstances up to Kuka, a connection having thus been made between Ibi and that place, *viâ* Bauchi and Gombe, by a line of latitudes and azimuths up to the frontier of Bornu, and afterwards by a rigorous traverse. Since arriving at Kuka the leader and Mr. Talbot had carried out a trip on Lake Chad, making a sketch-map

* The somewhat similar delineations of a peninsula by Mercator (1538) and by Gemma Frisius (1551) have a different origin, being evidently modifications of the great south-eastern peninsula of earlier maps, itself a survival of the Ptolemaic influence.

of the portion visited. From Lieut. Alexander's account, it appears that the configuration noted by French officers on the eastern side of the lake extends also to the west, the whole of the portion navigated being filled with a network of islands. Starting from Kadde, which is close to the lake and about 20 miles north of Kuka, the explorers went north-east to a point about 30 miles due east of the mouth of the Yo river. It had been impossible to proceed south-east, owing to the many belts of marshy islands half under water. The majority of these are from 1 to 5 miles in length, with a sandy, shelly soil. They are covered with short coarse grass, with occasional belts of high reeds or low bushes. The Maria bushes, of which thick belts were seen fringing the lake-shore south of Kadde, were not, however, observed on the islands. On several islands collections of low deserted grass huts were seen, but it was impossible, throughout the journey, to get in touch with the Budduma, who always fled on the approach of the white men. They seemed to possess large herds of cattle, and have numbers of canoes made of dried reed-stalks tied together in layers. These are picturesque in appearance, being in shape like the Venetian gondola. Soundings were constantly taken, and the depth of the lake found to be almost uniformly from 1 to 1½ foot, though between the Yo mouth and Kadde it reached 2½ to 4 feet. The bottom is shelly and sometimes firm, but more usually consists of soft black mud. The wind, which is generally north-east, appears to influence the level greatly, a fall of 10 inches being on one occasion observed in a single night. Owing to the shallowness of the lake and the many islands, it was found impossible to take the expedition across to the Shari mouth, so the bulk of the expedition was to go round through the Kotoko country. Lieut. Alexander hopes, if possible, to push on to the south-east through the little-known region between the Shari and upper Nile, returning by the east coast. A few additional details are contained in a letter from Captain Gosling, who says that the Yo is a wonderful little river, being at high water at Yo in December, while all the surrounding country was dry and burnt up, the scanty rains having ceased about August. Mr. Talbot, whose aid in the survey work is said to have been invaluable, has returned home, bringing with him the map so far as completed. Altogether an excellent piece of work seems to have been accomplished.

Flint Implements from the Fayum.—Mr. H. W. Seton-Karr sends us a short printed description of the flint implements discovered by him in the Fayum during his expedition in October, 1903. It includes an extensive series of illustrations (both drawings and photographs) of the principal objects found, which will be useful as giving a comprehensive view of the whole collection previous to its distribution among widely separated museums. The objects are found, not only along the border of the ancient lake, but on any ground in the vicinity where there are no sedimentary deposits or superimposed material from the weathering of cliffs, etc., or from sand drift; provided that material was available in the form of flint and agate boulders, and that settlements of pre-historic man existed in the neighbourhood. The first condition is met on the summits of undulations where the prevailing north wind keeps the sand from settling, especially on the north sides. Mr. Seton-Karr thinks that implements of many different epochs are mixed up on the surface of the Fayum desert, and, while not stating definitely that any are of Palæolithic age, holds that man existed here during the glacial epochs. Among the implements not figured are some mealing-stones or corn-grinders, and a series supposed to be fish-scaling knives, representing a type peculiar to the Fayum, which has been placed in its entirety in the Cairo Museum. The objects figured include arrow and lance heads, saws, borers, knives, axe-heads, as well as many of uncertain use; some crescent-shaped, others apparently to serve as adzes, etc., etc. Some of the types appear to be unique.

Northern Territories of the Gold Coast.—The report of Lieut.-Colonel A. Morris on the Northern Territories of the Gold Coast for 1903 (Colonial Reports, Annual No. 429) shows that the general condition of the protectorate is satisfactory. A station was established at Salaga in June, 1902, and has led to a great influx of trade and to a considerable increase in the caravan tax. The general health of Europeans in the protectorate is good, the climate of the Northern Territories, in Colonel Morris's opinion, being much superior to that of the coast. Salaga is apparently the most unhealthy, while Gambaga has the healthiest record. Considerable progress has been made during the year in mapping the protectorate. The greater portion of the Kintampo district has been sketched, as well as the country extending from Gambaga nearly 40 miles to the south and west; the north-western portions of the Black Volta district lying between 10° and 11° N. lat., and 2° and 2° 45′ W. long.; and the Volta from Yeji to Wuyima. Sketches on a large scale have also been made of the environs of Gambaga, Salaga, Wa, and Kintampo, to a radius of five miles. The protectorate appears suitable, both as to soil and climate, for the cultivation of cotton, and the success of this commodity as an article of export seems to mainly depend on the facilities of transport; the best districts, therefore, for growing cotton would be in the immediate vicinity of the Volta river. The cost of transport has been considerably reduced since the opening of the Volta River Transport Service, but is still very high. Two new roads have been completed—the permanent road between Gambaga and Salaga *viâ* Patenga and Khobia, 150 miles long and 16 feet wide, and a road from Wa to Gambaga, joining the old main road from Gambaga at Bimba.

Railways in British West Africa.—A Bluebook issued in December, 1904, reports that there were then in full working order 135 miles of railway (2 feet 6 inches gauge) in Sierra Leone, and 87 still in course of construction; 125 miles (3 feet 6 inches gauge) completed in Lagos; and 170 completed in the Gold Coast, making altogether 430 miles completed in the three colonies. In the case of all three railways the construction has been carried out tentatively by sections, a policy framed with a view to the general interest of each colony rather than to rapidity of construction. The difficulties of railway construction in West Africa include the want of landing facilities, sickness of the staff, excessive rainfall, obstruction caused by the dense tropical forest, and the necessity of carrying on the entire work and conveying all the materials from one base. In Sierra Leone, the first 32 miles of line running eastwards from Freetown to Songo Town was completed in December, 1898; the next 23 to Rotifunk in March, 1900; the next 80 to Bo in October, 1902; while of the 87 miles of the Bo-Baiima section, 51½ were completed in February, 1904. A local line to meet the needs of officials residing on the salubrious heights above Freetown, and necessitating steep gradients (1 : 23) for a large part of the route, was completed and opened on March 1, 1904. In Lagos the railway line of 125 miles, from Lagos Town to Ibadan, has been in running since December, 1900. It includes the Denton Railway Bridge from Iddo island to the mainland. A short branch, 1½ miles long, from Aro across Ogun river to the gates of Abeokuta, has also been constructed. The bridge across the Ogun is 549 feet long. The Gold Coast line, from Sekondi to Kumasi, was completed in September, 1903.

Surveys in South Africa.—The report of the astronomer at the Cape for 1903 announces the completion of the field-work and computations relative to the survey of the Anglo-German boundary of South-West Africa, while the reduction of the geodetic survey of Southern Rhodesia is also completed. Operations in connection with the measurement of the arc along the 30th meridian from the Zambezi to Lake Tanganyika, under the direction of Dr. Rubin, were in progress

during the year, but owing to grass fires little could be done beyond reconnaissance, beaconing, and astronomical observation. A site for a base line was selected on a plain alongside the river Loangwa, near its intersection with the 15th parallel of latitude. Under the superintendence of Colonel Morris, geodetic operations in the Transvaal and Orange River Colony commenced in January, 1903. This survey will embrace the following series: Newcastle (Natal) to the Limpopo (along the 30th meridian), 415 miles; Limpopo to Ottoshoop, 230 miles; Belfast to Ottoshoop, 240 miles; Newcastle to Christiana, 220 miles; Ottoshoop to Kimberley, 245 miles; Pretoria to Cala (through Kroonstad), 405 miles; Hopetown to Natal (through Wepener), 320 miles; Newcastle along 28th parallel to the sea, 140 miles;—the whole representing a chain of triangulation of approximately 2215 miles. As a result of Lord Milner's endeavours for the creation of a topographic survey of British Africa south of the Zambezi, we learn that the Transvaal and Orange River colonies have provided an organization sufficient to complete the principal triangulation of these colonies in three or four years, and to make connection with the systems of principal triangulation in the Cape Colony and Natal. It is also proposed to carry out the triangulation through Basutoland and the portion of Zululand annexed to Natal, the cost to be defrayed by the Governments concerned. Thus, it is shown, the whole of British South Africa, with the exception of Bechuanaland, will be on an equality in the matter of survey, should the Government of Rhodesia agree to the connection of Gwelo with the Geodetic system south of the Limpopo.

The Madagascar Railway.—With a view to celebrating the inauguration, on November 1 last, of the opening of the first 102 kilometres (63 miles), between Brickaville and Fanovana, of the railway which, when completed, will connect the port of Tamatave with the capital of Madagascar, the *Revue de Madagascar* (6e Année, No. 12) devotes some fifty pages to a consideration of the whole line, that still in construction as well as that opened, and gives an interesting running description, geographical and geological, of the country the line passes through. Leaving Tamatave, a short coast railway runs to Ivondro. Thence the route runs south, through coast lakes by a canal to Brickaville, at the confluence of the Vohitra and the Ronga-Ronga, 9 miles in a bee-line from the coast. Two years ago a village of twenty huts, Brickaville has now, besides its station, a hotel-buffet with twenty rooms for travellers and two wings for accommodation of soldiery *en route*. Thence the railway skirts the Vohitra, traversing flat lands abounding in bananas, ravenalas, and mangoes. Sixteen kilometres from Brickaville the line reaches the station Aniverane, the capital of a district where are quartered the railway management and principal offices, houses for the staff, stores, engine sheds, repairing shops, coal, water-supply, etc. Thence the railway bends west, still following the river and penetrating a rugged region, such as is characteristic of many parts of the island. The first rapids are seen between the 18th and 19th mile. At Fanosana (28 miles) the line leaves the Vohitra to traverse a valley and strike the chain of Vonga-Vonga, which it penetrates by a tunnel of over 800 yards. The bed of the river to which, at 32 miles, it returns, becomes more rugged, the vegetation thinner, and the scenery wilder. This bed it ascends, now closely edging the river, and now boring its way among isolated hills. At 51½ miles the line finally leaves the Vohitra. It was at Fanovana, the present terminus of the line, that the banquet of inauguration was held. Trains leave Brickaville every Wednesday and Saturday; a first-class ticket costing 40.80 fr., a second half that price.

New Arrangement with Italy respecting East Africa.—By a convention between Great Britain and Italy, signed on January 13 last, a small piece of

territory has been made over to Italy immediately north of Kismayu, the motive being to give to the southern part of Italian Somaliland a better outlet than it has hitherto possessed. A strip of land connecting the port with the trade route to Lugh, on the Jub river, has at the same time been leased to Italy. Sovereign rights have also been acquired by the latter over the portion of the coast hitherto held by a ninety-nine years' lease from the sultan of Zanzibar. This territory, which has hitherto been administered by a chartered company, will in future depend directly on the Government.

The Usambara Railway.—This railway in German East Africa, which halted so long at its first terminus at Korogwe, is now being carried further into the interior, and has reached Mombo, some 30 miles north-west of the former place, the new section being formally opened on February 19. The *Deutsches Kolonialblatt* for March 1, which supplies this information, gives a map showing the route of the railway from the port of Tanga to Mombo. Between Korogwe and this place it skirts the western side of the Usambara highlands.

AMERICA.

Two New Canadian Provinces.—A bill authorizing the creation of two new provinces in Central Canada was introduced on February 21 before the Canadian legislature. According to its provisions, the provinces will be named Saskatchewan and Alberta, but the limits will be considerably wider than those hitherto assigned to the territorial divisions of those names, Assiniboia and Athabasca, as well as a portion of the north-west territory, being apparently absorbed into the new provinces, which will, together, extend from Manitoba to the Rocky mountains, and from the United States frontier to the 60th parallel. This vast area will be divided into two almost equal parts, each with an area of about 225,000 square miles. Each province will have a legislative assembly of twenty-five members, and the capital of Saskatchewan will be Regina, that of Alberta being temporarily located at Edmonton until a final decision is arrived at by the legislature. It is hinted that the provinces of Quebec, Ontario, and Manitoba may all be extended northward to the shores of Hudson bay. The date proposed for the creation of the new provinces is July 1 of this year.

The Glaciers of Alaska.—Prof. George Davidson has carried out an interesting study of the glaciers of Alaska, as shown on Russian charts or mentioned in the narratives of early explorers, with a view to elucidating their subsequent movements of advance or retreat by comparison with the statements of recent authorities. Of the Russian charts those of Tebenkof (1852) are of course the most important, though themselves based largely upon the surveys of Vancouver and others, and they have been taken by Prof. Davidson as the basis for his study. The earlier travellers include (besides Vancouver) La Pérouse, Malaspina, Whidbey, Belcher, Lütké, etc.; while from more modern times the writer has studied the works of Blake (1863), Muir (1879 and after), Abercrombie (1884, 1898), Reid (1890), Russell (1891 and later), Klotz (1893–94), the Harriman Expedition (1899), and several others. He finds that the glaciers shown by Tebenkof on his charts number thirty in all, while those for which there is no Russian authority number about one hundred. The former are so characteristically shown that there is no possibility of misreading them. Beginning from the Aleutian islands in the west, Prof. Davidson takes the whole series of glaciers in order, describing each in turn as observed by its chief investigators. He has also drawn a useful series of eleven charts, on which he has shown both the original Russian delineation and important recent changes. Some of the most interesting of these are to be seen at the head of Yakutat bay, where Malaspina's chart of 1791 (reproduced by Dr. Davidson) shows

the ice as reaching well below the termination of Disenchantment bay (which it therefore completely masked), while at the present day the open water extends so far up that some of the branches of the original glacier are now quite independent, as shown by recent Canadian reconnaissances. Summing up, Prof. Davidson shows that there seems to have been a general recession of the glaciers through the Aleutian islands, the Peninsula of Alaska, and from Cook's inlet to Portland canal, except where they come directly or almost directly upon the broad ocean. Evidences of advance are shown, among others, by the Malaspina glacier, which has filled and obliterated the icy bay of Vancouver and Tebenkof; by the glaciers of Lituya bay, which have shortened the deep arms described by La Pérouse; and by the La Pérouse glacier upon the ocean shore. It is, however, in this very region of advance that the ice has retreated, as above mentioned, from the head of Yakutat bay. In conclusion the writer urges the importance of systematic observations on the climatology of the whole region in question, at well chosen stations.

Dome Structure in the Sierra Nevada.—In the January number of the *Sierra Club Bulletin* there appears an article by Mr. G. K. Gilbert (originally printed in the *Bulletin* of the Geological Society of America for February 10, 1904) on the dome-like forms which characterize so many of the summits in the granite areas of the Sierra Nevada. Discussing the two theories according to which such forms are due, (1) to original structure, antedating the sculpture of the country and determining the peculiarities of form; (2) to some reaction from the surface, which induced the observed structure subsequently to the origination of the form; he finds that the latter explanation fits in better than the former with the facts of the case. The dome-structure is not found in rock which is divided by systems of parallel plane joints, for in large areas where the granite is so divided into angular blocks the domes are not met with. On the other hand, where there is but a single set of division-planes, and where disintegration is therefore retarded, the granite masses stand out as prominent dome-shaped hills. The structure resembles the exfoliation caused by the effects of expansion or contraction, such as, *e.g.*, are produced by a forest fire, or by the cooling of a lava-stream, and it is expansion that seems the more probable cause in the case of the domes. It may, Mr. Gilbert thinks, be the result of dilatation following on the unloading of a deep cover of older rock. The rounded form of the domes tends to become more and more pronounced as each successive layer is removed, the departures from strict parallelism between the surfaces of partition being such as to reduce or omit angles and other features of irregularity, so that the inner partings reflect only the general features of the external sculpture. In opposition to these forces, corrasion has worked also in this region, and one of its most conspicuous traces is to be seen in the mountain known as Half-Dome, the base of which was sapped by glacial corrasion, and a part of the mountain was thereupon sheared off by gravity, leaving a flat vertical face, in which the "dome-structure" was afterwards developed, the new partings being here plane, and simulating ordinary joints.

AUSTRALASIA AND PACIFIC ISLANDS.

Flora of the Islands south of New Zealand.—The flora of the small islands dotted over the ocean to the south of New Zealand (Auckland, Campbell, Antipodes, Bounty, etc.) presents some interesting problems in connection with the subject of the distribution of plants over the southern part of the southern hemisphere. These islands, while showing many floral affinities with New Zealand, have this in common with the rest of the ring of small islands which encircles the globe in these latitudes, that they contain an element to which the name "Fuegian"

has been given by botanists. Our knowledge of the flora of these islands (to which one of the earliest and most important contributions was made by Sir Joseph Hooker during the Ross Antarctic expedition) has lately been extended by the researches of Dr. L. Cockayne, who, in 1903, visited most of the groups on board the *Hinemoa*, one of the boats sent periodically by the New Zealand Government in search of possible castaways. His visit was of interest from the fact that it was made in winter, while all previous botanical observations had been made in spring or summer. The results obtained are communicated at length in vol. 36 of the *Transactions and Proceedings of the New Zealand Institute* (Wellington, 1904). Dr. Cockayne gives a sketch of the geology, climate, etc., of all the islands visited, and treats at length of the principal plant-formations represented in each, concluding with some interesting general remarks on the history and affinities of the flora as a whole, and the modifications to which it has or is likely to be subject through external agencies. The general character of the climate of all the islands seems to be marked by cloudy skies, frequent showers, a mild temperature in winter, but a cool summer, with, finally, furious gales and squalls with hail or sleet, of the effect of which the aborescent flora bears abundant evidence. One of the most remarkable of the formations represented is the "Rata-forest" of the Auckland group, in which *Metrosideros lucida* is the dominant tree. It forms a belt, sometimes of great luxuriance, round a large part of the coasts. The physiognomy and interior contents of this forest are the resultant of two opposing factors, the one tending to produce a xerophytic, the other a hygrophytic flora. From its moisture and equable nature the climate would be an ideal rain-forest one, but as opposing factors we have the low summer temperature and the furious winds. These last have led the trees to form a dense flat roof of foliage, with a luxuriant lateral growth of the branches, and beneath this canopy the hygrophytic factors can exercise full sway, as shown by the abundance of filmly ferns, liverworts, etc. Another type of forest is that of *Olearia Lyallii*, which occurs locally only, but grows with great luxuriance, so that there seems no reason why it should not be the dominant forest of the southern islands. Possibly the case is one where a very slight change of conditions has caused an older formation to be ousted by a newer one. As regards the effect which introduced animals have had on the flora, this is principally to be observed in Campbell's island, where sheep-farming is now an accomplished fact. Taken as a whole, the flora consists of the following elements: Of the flowering plants, 39 per cent. are endemic; 18·8 per cent. Fuegian (including 5 per cent. which do not extend to New Zealand); and 42 per cent.* New Zealand, excluding those also Fuegian. Of the plants which extend to New Zealand, nearly half are mountain plants, while the remainder includes plants of a forest which ascends to the sub-alpine region, or grows under more or less alpine conditions. The presence of the Fuegian element is, in Dr. Cockayne's opinion, rather to be explained as due to former land connections than to the agency of birds, winds, currents, etc., and this is borne out by the occurrence of the Rata forest—a distinct plant-formation such as might be found in many parts of the south island of New Zealand.

A Magnetic Survey of the North Pacific.—Prof. L. A. Bauer contributes to *Nature* of February 23 last some account of a magnetic survey of the North Pacific ocean to be commenced during the present year under the auspices of the Carnegie Institution, which has made an initial allotment of $20,000 to cover the first year's expenses. Prof. Bauer points out the reasons which make such a survey eminently desirable, and quotes the opinions of Captain Creak, Prof.

* Dr. Cockayne's figure is 43·1 in this case, but this is a miscalculation.

Schuster, and Mr. O. H. Tittmann, in favour of the inception of the work. Our knowledge of the distribution of the magnetic forces over the oceanic areas—that is, over the greater portion of the Earth's surface—is extremely defective, the existing charts depending—apart from comparatively few and isolated data—on observations made on islands or along the coasts, which are liable to be affected by local disturbances. The plan of the survey has been worked out by Mr. G. W. Littlehales, and involves the purchase of a wood-built, non-magnetic sailing vessel of about 600 tons displacement, which, starting from San Francisco, shall pursue a spiral course of about 70,000 nautical miles, embracing eventually the entire North Pacific ocean. The course, which has been chosen so that the best advantage may be taken of meteorological and other factors, will lead in succession through each of the five-degree quadrangles in which values of the three magnetic elements will need to be obtained; the first circuit leading round the periphery of the North Atlantic *viâ* the Galapagos, Philippines, and Japan, while the second will lead through the series of quadrangles lying next on the mid-ocean side of that previously traversed, and so on. The region contains sufficient magnetic observatories to supply the necessary corrections for reducing the observed magnetic elements to a common epoch, continuous records being available from Sitka, Mexico, Honolulu, Manila, Shanghai, and Tokio, while it is hoped that there may soon be another such in or near California, and that the German station in Samoa will be maintained during the course of the survey. It is thought that opportunity will be afforded by the survey of studying the effect of the configuration of land and water upon the distribution of the magnetic forces, as it is to be expected that distortions and anomalies will be revealed in the neighbourhood of islands and coasts. The first circuit will be particularly interesting from this point of view. It is hoped that three years will suffice for the entire work of observation and reduction, and that similar work may be in time undertaken for other oceanic areas.

POLAR REGIONS.

The French Antarctic Expedition.—Dr. Charcot's expedition, to the expected return of which reference was made in our last number, arrived in safety at Puerto Madryn, in the Chubut territory of Patagonia, on March 4, and any uneasiness that may have been felt owing to the return of the Argentine gunboat *Uruguay* without tidings of the party has therefore been quickly allayed. As we pointed out, however, in referring to the report of the *Uruguay's* commander, the failure to find traces of the expedition in the latitude reached by that vessel gave really no ground for alarm. A telegram has been received in Paris giving a few details as to Dr. Charcot's experiences, which are reproduced in the February number of *La Géographie*. The *Français* wintered at Wandel island, at the southern extremity of Gerlache (formerly Belgica) strait, in 65° S. Thence an expedition to the south settled the question of Bismarck strait, the western end of which was discovered by Dallmann in 1874, but the exact character of which had been hitherto in doubt, as its communication with the sea on the eastern side of Graham Land had not previously been demonstrated. The French expedition has also laid down the contours of the west coast of Graham Land, landings being effected at several points, and of the "Palmer archipelago," by which Dr. Charcot seems to understand the islands separated by Gerlache strait from the main landmass. It also pushed south-west within sight of Alexander I. Land, but the impenetrable ice-pack prevented it being reached. On the coast of Graham Land the *Français* ran aground and sprung a serious leak, but this danger was happily overcome. The expedition appears to have made some useful additions to our knowledge of these southern regions.

GENERAL.

An Interesting Chronometer.—Through the kindness of the Secretary of State for India, the Society has recently received an interesting addition to its collection of relics of early explorations. This consists of a ship's chronometer, which was used by Captain J. Parry on board H.M.S *Hecla* on his voyage in the Arctic Regions for the discovery of the North-West Passage in 1824, and which was subsequently used on board H.M.S. *Volage* during her voyage round the world, 1826–29. Previous to being taken over by Captain Parry, the chronometer had, in the same year, gained the first prize at Greenwich, its variation for a period of twelve months being only 1·11 second. During both the voyages referred to its performance was such as to merit the unqualified praise of the captains and officers of both ships. The chronometer has lately been deposited in the Indian Government Stores Depôt, and the Secretary of State, thinking it would be of interest to our Society, has kindly given permission to have it handed over to us.

Geography at Cambridge.—The new regulations proposed by the Board of Geographical Studies at Cambridge, and recently adopted by the Senate, mark an important step forward in the cause of geographical education in this country. The regulations have to do, firstly, with the Special Examination in geography for the ordinary B.A. degree, which will in future be held twice a year, like others of the undivided Special Examinations; and, secondly, with the Examination for the newly instituted Diploma in Geography. The first-named will be both in writing, and oral and practical, and will have reference to the following subjects: Physical, Historical and Political, and Economic Geography, and Cartography, with (as voluntary subjects) the History of Geographical Discovery and the Elements of Ethnology; six papers, one for each of these subjects, being set. The examination for the Diploma in Geography will be in two parts, Part i. being identical with the Special Examination, while candidates who have passed the examination under the one name will be held to have passed also under the other. Part ii., which can only be taken by those who have already satisfied the examiners in part i., includes subjects which are to be treated in an advanced and comprehensive manner. They will be: (*a*) Regional Geography, (*b*) Surveying and Mapping, (*c*) Geomorphology, (*d*) Oceanography and Climatology, (*e*) History of Geography, (*f*) Anthropogeography. Of these all candidates will be required to take (*a*) and (*b*), together with two at least of the remainder. The range and contents of the six subjects have been subsequently defined by the Board. There is, naturally, a certain amount of overlapping between some of the subjects, Regional Geography being the most comprehensive, and having to do with portions at least of several of the other more special subjects. The first examination under the new scheme will be held in the Easter Term of the present year.

The Oxford School of Geography in 1904.—The attendance of students during the three terms in 1904 has been 117, 141, and 146 respectively, as against 137, 104, and 115 in 1903. A large proportion of the students still attended the Reader's lectures only, but the number of those receiving practical instruction rose from three in the Hilary term to eight in the Michaelmas, which is a satisfactory feature. Several graduates were students of the school, which was attended also by visitors from the United States, Germany, Italy, and Egypt. The scholarship for 1904–5 was awarded to W. J. Barton, B.A., Scholar of New College; and the diploma was gained by Miss M. E. MacMunn. The equipment continues to be improved by purchases and gifts, and the collection of large-scale maps of Central Europe and the British Isles is an extensive one. At the Vacation course, held from August 2 to 16, thirty students attended.

The Fourteenth Congress of Orientalists.—As already announced (*Journal*, vol. 23, p. 792) this Congress will meet at Algiers at Easter of this year. A circular has been issued, giving practical information as to hotels and lodgings (of which a good supply is available), and as to the days of sailing of various lines of steamers and the rates of reduction allowed. The titles of communications intended for reading at the Congress will be received up to the day before the opening meeting.

OBITUARY.

The Earl of Southesk.

THE death occurred on February 22 last, of the Right Hon. the Earl of Southesk, K.T., who had been a Fellow of our Society since 1860. The deceased peer, who was born in 1827, was eldest son of the late Sir James Carnegie, whom he succeeded as sixth baronet of Pitbarrow in 1849, having previously served successfully in the Gordon Highlanders and the Grenadier Guards. In 1855 he succeeded in establishing his claim to the Earldom of Southesk, which had been forfeited by the fifth earl for the part which he took in the rebellion of 1715. Lord Southesk was well known to geographers for his extensive travels in the north-west of North America nearly half a century ago, during which he traversed some of the wildest and least-known portions of the Rocky mountains, about the sources of the Athabasca and Saskatchewan (cf. *Journal*, vol. 13, p. 546). He described these travels in an interesting work entitled 'Saskatchewan and the Rocky Mountains,' published in 1875. His youngest son was the late Hon. David Carnegie, whose excellent work in Australia and Nigeria is well known to readers of the *Journal*.

Stephen William Silver.

With sincere regret we have to record the death of Mr. S. W. Silver, one of the Society's oldest and most esteemed Fellows, who died at his country seat, Letcomb Manor, Wantage, on the 7th inst.

Until about a month ago, our old friend and associate was travelling regularly to London to attend his various Board meetings, and his health seemed to indicate that he would continue with us some years longer. In February he caught cold on the lungs, and was confined to his house at York Gate for two or three weeks. A man full of energy, he apparently made a quick recovery, was permitted to return to Letcomb, but had a relapse, and passed away, after a few days' illness, at the ripe age of eighty-five.

Born in London in 1819, Mr. Silver succeeded, in 1846, to the management of the export and banking business founded by his father, a business having its agents and correspondents in all parts of the world. S. W. Silver & Co.'s monthly *Circular* soon merged itself into an *Emigrant's Guide*; that in time expanded into a Series of Handbooks to each group of colonies in Australasia, Canada, South Africa, and the West Indies; while to these publications was added the fortnightly, afterwards weekly newspaper, the *Colonies and India*, now extinct.

After his retirement from the City business, Mr. Silver continued for many years chairman of the India-rubber and Telegraph Company, having its works at Silvertown. He was also a director of the London Life Association, a Past-Master

of the Ironmongers' Company, and a Deputy-Lieutenant of the City of London; Governor of St. Thomas's, St. Bartholomew's, and Bridewell Hospitals; Fellow of the Linnæan, Botanic, Zoological, Colonial, and Bible Societies, as well as the Geographical: in all he took a very active interest.

Elected a Fellow of our Society forty-six years ago, it was not long before he was sitting at the Council table with Sir Henry Rawlinson, Lord Houghton, Admiral McClintock, Prof. Huxley, Clements Markham, Sir Bartle Frere, and other noblemen and gentlemen, Sir Roderick Murchison presiding. He was again and again re-elected to the Council, for his business experience was invaluable, particularly in matters of finance. He also served on the Library and Reception Committees.

Without any pretence as a scientific geographer, Mr. Silver was yet well informed upon the progress and results of modern exploration. Few men could follow the course of a traveller more intelligently; indeed, he was minutely acquainted with the routes of African explorers, and intimate with Livingstone and Moffat, Burton and Speke, Baker and Consul Petherick, Cameron, Holub, Selous, Thomson, and many more. One was always certain of meeting visitors from different parts of the world at his table, either at his club or at his town house, York Gate; a favoured few were made welcome at the "Benhams," Letcomb, where Mr. Silver was long privileged to exercise the influential position of a "lord of the manor." To not a few travellers he gave useful advice, and where necessary extended a helping hand. Joseph Thomson, returning home in a dying condition, spent his last days at York Gate. There Mr. Silver had collected his valuable geographical and colonial library, which was always accessible to visitors and searchers. He considered himself amply repaid by the use young students made of the collection, and was more than gratified when the printed catalogue found its way into some of the principal libraries as a work of reference.

Modest and unassuming, and unostentatious in all his doings—it was only upon very rare occasions that his voice was heard—Mr. Silver took a personal interest in the welfare of every one with whom he associated. He will be missed far beyond his own immediate circle of friends, which is a very large one, and remembered for his kindly and agreeable manner by all who came in contact with him.

E. A. P.

Gabriel James Morrison.

In Mr. Gabriel J. Morrison, M.I.C.E., M.I.E.E., who died in London on February 11, at the age of sixty-four, the Society lost a member who throughout his life had taken a keen interest in geography, and a part, and that sometimes a leading part, in several of the enterprises in the latter part of the last century, which were the initial stages towards the development of new fields of science and of commercial activity.

In 1856–57, while attending the class of natural philosophy at Glasgow University, under Prof. Thomson (now Lord Kelvin), he devoted himself to the study of electricity, and to experiments in conductivity, insulation, etc., and early in 1858, when only eighteen years of age, was asked by Prof. Thomson to assist in electrical experiments, and, if necessary, in the laying of the Atlantic cable. This led to his sharing in all the adventures which attended that enterprise in 1858, and after the connection between England and Newfoundland had been established, he remained at the western station until the fading life of the cable expired in a last message from Mr. Morrison to Prof. Thomson.

On his return to Scotland he was principally engaged in railway engineering. In 1863 he joined the staff of Mr. (afterwards Sir James) Brownlees, and after acting as resident engineer on several railroads and public works, and preparing surveys of other railways both at home and abroad, left for China as engineer-in-charge of the railroad from Shanghai to Woosung, which it was expected would pave the way for the early extension of railroads throughout the country. The railroad was begun and completed in 1876, but encountered official opposition, and, after being sold to the Chinese Government, was torn up the following year.

Mr. Morrison stayed on in China in the vain hope that the attitude of the Chinese Government towards railway extension would change, and while practising as a civil engineer in Shanghai made many journeys in the country, surveying routes which were likely to be adopted. The most notable of these was in 1878, through the province of Hunan, which was at that time intensely hostile to foreigners. His experience there was most trying, but, in spite of being hooted from place to place, he travelled almost the whole distance on foot, in order to be able to conduct a rough survey.

But his connection with the Shanghai-Woosung railway was fatal to his employment in any similar enterprise favoured by the Government, though his advice in other matters, such as the closing of the breach in the Yellow river in 1888, was sought by Li Hung Chang. On this matter it is worth recording that he stated that the native methods had best be persevered in, and his opinion was justified by their success.

About 1880 he travelled in Cambodia, where he had an interesting interview with the king. And in 1883 he made several visits to Korea, which at that time had not yet been opened to foreigners, with a view to ascertaining its mineral resources, and the first foreign mining enterprise in that country was started in consequence of his investigations. In 1889 he travelled in Tonquin to examine some coal-mines.

After leaving Shanghai in 1902, he was associated with Sir J. Wolfe Barry as consulting engineer of the Shanghai-Nanking railway, which is now in course of construction, and thus before he died had at last the satisfaction of participating in the development of the enterprise which he so long had at heart.

A paper by him on "Journeys in the Interior of China" was read before the Society in 1880. Besides this he wrote numerous papers, *e.g.* "A Visit to and Description of the Island of Formosa," "Inland Communications in China," "Breach in the Embankment of the Yellow River," "Engineering in China," "A Trip to Corea," "Journeys from Hankow to Canton and from Chinkiang to Tientsin," which for the most part are to be found in the *Proceedings* of the Institute of Civil Engineers or in the local press of Shanghai. A paper on "Great Circle Sailing," read before the British Association at Belfast, was afterwards expanded by him in his 'Maps: their Uses and Construction,' published by Stanford. This work was extended, and considerably improved in the second edition, which appeared in 1902, and is now one of the most useful elementary text-books on the subject.

Mr. Morrison took an active part in the public life at Shanghai, where his services as colonel of the volunteer corps, and as municipal councillor, provoked a very hearty manifestation of esteem on his departure in 1902.

He was elected a Fellow of the R.G.S. in 1881, a member of the Institute of Civil Engineers in 1874, received the Watt Medal (1876), and was elected a member of the Institute of Electrical Engineers in 1884. He was also elected first president of the Society of Engineers and Architects in Shanghai, 1901.

W. R. C.

Prof. Eduard Richter.

Geography has sustained a severe loss by the death, on February 6 last, of Prof. E. Richter, of Graz, one of the best Continental authorities on the Alps and their glaciers, the scientific study of which was greatly furthered by his work and influence. This was, however, but a part of his many-sided contributions to geographical science, one of his most striking characteristics being the breadth of his outlook, which enabled him to give due weight alike to the physical and to the historical sides of geography, much of his most important work being concerned with the latter. Born in 1846, Richter became in time professor at the "Gymnasium" at Salzburg, where his first opportunities of studying the alpine glaciers were gained, their outcome being his first published work entitled 'Die Gletscher der Ostalpen' (1888). Another important field to which his energies were afterwards devoted was that of limnology, in which he did much to improve our knowledge, especially as regards the lakes of the eastern Alps. To him was due the first clear recognition of the strongly marked dividing-line between the warm surface water and colder bottom water of many lakes, and the term "Sprungschicht," now generally used in Germany to denote the level at which this fall occurs, was originated by him. Among the results of his investigations in this field may be mentioned his 'Seenstudien' (1897), which formed a commentary on the second part of the 'Oesterreichischen Seenatlas.' Other important works were his large work in three volumes entitled 'Die Erschliessung der Ostalpen' (1893–1894), and his study of the morphology of the Alpine peaks published in 1901 as a supplementary number of *Petermanns Mitteilungen.* From 1895 onwards he had worked energetically on the great "Geschichtlichen Atlas der Oesterreichischen Alpenländer," undertaken by the Vienna Academy of Sciences at his instigation. He unfortunately did not live long enough to see the first instalment of this work in print, though the manuscript was practically ready at the time of his death.

The Rev. S. L. Graham Sandberg.

Mr. Graham Sandberg, whose death on March 2 we regret to record, was a well-known authority on Tibetan questions, with which his knowledge of the Tibetan language made him exceptionally competent to deal. Only in 1902 he had acted as joint editor of the great Tibetan-English Dictionary compiled by Sarat Chandra Das for the Indian Government, and still more recently he had brought out a useful summary of the history of Tibetan exploration, in which he always took a great interest. Before the late expedition to Lhasa was decided on, he had given much care to the collection of information as to routes to that city, publishing the results in 1901. Mr. Sandberg was a senior chaplain on the Bengal establishment.

CORRESPONDENCE.

Protection from Snow-glare.

In Dr. Hunter Workman's interesting paper published in the March number of the *Geographical Journal,* he speaks of various devices for mitigating the effects of reflected heat from snowfields on the skin. It may interest him to hear that I have tried a mask made of yellow muslin for the purpose, and found it worse than useless.

The people of Chitral and Washigam, when taking their women on a journey, cover their faces with a preparation of clarified butter and burnt horn, with the idea of preserving their complexions, and they say it is very effective. Another alleged reason for this practice is, that it was originated by an edict made by a former *Mehtar*, in consequence of the loose state of the morals of the country, the motive being that women would thereby be rendered the reverse of attractive when they went in public.

As the faces of little children are also anointed in the same way when exposed to the sun, it seems likely that the first reason given is the true one.

R. L. KENNION, Major.

Bournemouth, March 11, 1905.

Botany of Grinnell Land.

Carrablagh, Portsalon, Co. Donegal.

I have just finished reading Otto Sverdrup's 'New Land.' I find on page 470, vol. 2, mention of my name ("the aforesaid Mr. Hart") in connection with botanical collections in the neighbourhood of Hayes sound (Grinnell Land) in 1875. He says, "From his list must therefore be excluded" (naming five or six species), several plants which he, Herman G. Simons, did not observe. It is a very unsafe thing to exclude plants from a previous observer's list because one fails to find them. Two at least of those he mentions are the same as he records under more recent nomenclature (the Arctic poppy, and one of the most disputed Drabas). Under the same category may be placed a third, *Cerastium latifolium*. Another is *Pedicularis flammea*, in which there is no mistake; but these species of semi-parasitic plants are most uncertain in their appearances. *Carex rigida* is assuredly correct—a very familiar species to me. And my *Potentilla anserina* was *not* recorded by me from the district he speaks of (not north of Cape Sabine). There remains only *Pedicularis lapponica*, which, as being a critical and interesting plant, I selected for further inquiry. I wrote to Kew, where my collections are chiefly to be found, at the Herbarium. Mr. Hemsley courteously replied that specimens of *Pedicularis lapponica*, from Dobbins bay, are amongst my collections in that repository. I have no time to pursue the subject further, nor do I feel justified in wasting that (more precious still) of the keepers of Kew and other Herbaria by further inquiries.

H. C. HART.

P.S.—I do not think any other portions of this most interesting record of travels and endurance call for remark at my hand, but it is a blot on its pages to find the familiar musk-ox given a new, unsuitable, and evanescent name.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904-1905.

Seventh Meeting, February 27, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Gabriel Aarons; Captain Jas. Alex. Stewart Balmain* (15*th King's Hussars*); *Major A. P. Blenkinsop, R.A.M.C.; John Henry Close; Lieut. Hector James Doveton, I.A.; Prof. Chas. Reduay Dryer, M.A., M.D.; Walter Douglas Elwin; F. W. English; Rev. John Hedley; Major M. L. Hornby, D.S.O.; Captain C. A. M. Howard; D. H. Langlands; John Theobald Leonard; William James Myatt; A. H. Glendower Newcomen; Captain A. H. Ollivant, R.G.A.; John T.*

Petro; Captain C. MacI. Ritchie, R.A.; Lieut. John Maitland Salmond (Lancaster Regt.); Hans Sauer; Robert Scott; Major-General E. J. E. Swayne, C.B.; Captain F. G. Turner, R.E.; Brevet-Major Geo. Greville Woods, R.A.

THE ANTARCTIC MEDAL.

The PRESIDENT: Before asking Captain Scott to read his paper, it will be my pleasure to deliver to him the special Gold Medal which has been struck in his honour by the order of the Council, for it was only a dummy that we were able to give him at the reception at the Albert Hall. The real medal is now finished, and it is presented to him by the Council as mementos of their appreciation, their high appreciation, of the admirable way in which he conducted the expedition from start to finish, and of the appreciation we have of the valuable results of that expedition. I now place the Gold Medal in Captain Scott's hands.

The Council also resolved to present silver replicas of Captain Scott's medal to the officers and men of the *Discovery*. They will be mementos to them of their commander, to whom they were all deeply attached, and also of their own admirable work. I propose to deliver them to those who are present, and the others will be sent.

The President then presented the medals to the various officers.

Captain SCOTT: I must first of all thank you, sir, for the gift of the medal to-night. I hope, sir, that though the medal you gave us before was a dummy, you will appreciate that our thanks given at that time were not dummies, and that we fully appreciated the great honour that we had received from this Society. I am sorry that so few members of the expedition are here to-night. It is with regret that we find ourselves scattered after having been so long together, and it is especially grievous that we cannot foregather on such a night as this, that all, like myself, might have received this highly valued reward directly from your hands.

The Paper read was:—

"The Scientific Results of the National Antarctic Expedition." By Captain R. F. Scott, C.V.O., R.N.

Eighth (Extra) Meeting, March 10, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

As a considerable number of the Fellows were unable to obtain admission to the meeting on February 13, Sir Frank Younghusband kindly repeated his lecture on "The Geographical Results of the Tibet Mission."

Ninth Meeting, March 13, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Charles Francis Stanhope Bilbrough; S. Dickson Brown, M.A.; Lieut. J. Charteris, R.E.; Miles Wilfred Duffill; Francis Edwards; Arthur Fleet; Frederick Wm. Grantham; Christopher Richard Kempster, M.R.C.S., L.R.C.P.; Major R. J. Marker, Coldstream Guards, D.S.O.; George Frederick Stock; George Henry Vine; Sir James Lewis Walker, C.I.E.*

HONORARY CORRESPONDING MEMBER.

His Excellency Dr. Joachim Nabuco, Brazilian Minister.

The paper read was:—

"The Anglo-German Boundary Expedition in Nigeria." By Colonel Louis Jackson, R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Glaciers. *C. Rd.* 139 (1904): 1049-1051. **Jacob and Flusin.**

La crue glaciaire de la fin du XIXe siècle et les différents facteurs qui ont déterminé les anomalies de cette crue dans le massif du Pelvoux. Note de C. Jacob et G. Flusin.

Balkan Peninsula. **Meyer.**

Meyers Reisebücher. Türkei, Rumänien, Serbien, Bulgarien. Sechste Auflage. Leipzig und Wien: Bibliographisches Institut, 1902. Size 6½ × 4½, pp. xii. and 384. *Maps, Plans, and Illustrations. Price* 7.50*m.*

Denmark. **Löffler.**

Dänemarks Natur und Volk. Eine geographische Monographie. Von Dr. E. Löffler. Kopenhagen: Lehmann & Stages Verlag, 1905. Size 9 × 6½, pp. 118. *Maps and Illustrations. Presented by the Author.*

A good general picture of Denmark, the Færoes, and Iceland.

Scandinavia. **Bain.**

Scandinavia, a Political History of Denmark, Norway, and Sweden from 1513 to 1900. By R. N. Bain. Cambridge: The University Press, 1905. Size 8 × 5½, pp. viii. and 460. *Maps. Price* 7*s.* 6*d. Presented by the Publishers.*

The author holds that "the political history of Scandinavia is the history of the frustration of a great Baltic Empire." The main object which he has set before him is "to describe the rise of the Scandinavian kingdoms to political eminence, and their corresponding influence on European politics generally." There are maps illustrating political boundaries at various dates, and the gradual encroachment of Russia on Sweden.

United Kingdom—Worcestershire. **Duignan.**

Worcestershire Place-names. By W. H. Duignan. London: H. Frowde, 1905. Size 8 × 5, pp. x. and 186. *Price* 6*s. net. Presented by the Publisher.*

A careful investigation of the origin and history of the older place-names of Worcestershire, after the model of the same author's 'Staffordshire Place-names,' published in 1902. Books of the kind, of which several have appeared within the past few years, will materially help towards the eventual treatment of the whole

subject of British place-names, for a comprehensive work on which there is certainly room.

ASIA.

Asia. **Sievers.**

Asien. Von Prof. Dr. Wilhelm Sievers. (Allgemeine Länderkunde . . . herausgegeben von Prof. Dr. W. Sievers. Zweite . . . Auflage.) Leipzig und Wien: Bibliographisches Institut, 1904. Size 10 × 7, pp. xi. and 712. *Maps, Plates, etc. Price* 17*m.*

Like other volumes of the series, this has been thoroughly recast and revised in the second edition. It supplies, perhaps, the most accurate general account of Asia within the compass of a single volume that has been published.

Asia. **Tenney.**

Geography of Asia. By C. D. Tenney, LL.D. London: Macmillan & Co., 1904. Size 11½ × 9, pp. 76. *Maps. Price* 2 *dollars. Presented by the Publishers.*

The author is president of the Imperial Tientsin University, and has prepared this book for the use of English-speaking Chinese students. It shows few traces of the influence of modern conceptions as to the scope and function of geography, and is far too much a catalogue of facts without due correlation.

Asia—Meteorology. *Meteorolog. Z.* **21** (1904): 502–510. **Woeikof.**

Das sommerliche asiatische Luftdruck-Minimum. Von A. Woeikof.

Central Asia. *B.S.G. Italiana* **5** (1904): 451–490, 574–603, 633–671. **Brocherel.**

In Asia Centrale. Una esplorazione nel Tien Scian Centrale (Spedizione del principe don S. Borghese nel 1900). Per il Prof. G. Brocherel. *With Illustrations.*

Central Asia. *Ymer* **24** (1904): 237–258. **Hedin.**

De vetenskapliga resultaten af min sista resa. Af Sven Hedin. *Maps.*

China. **Hosie.**

China. No. 5 (1904). Report by Consul-General Hosie on the Province of Ssŭch'uan. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. 102. *Maps. Price* 1*s.* 10*d.*

China—Hainan. *Rev. Française* **29** (1904): 649–656. **Servigny.**

Hainan et son Commerce. Par J. Servigny.

Japan. **Rein.**

Japan, nach Reisen und Studien im Auftrage der Königlich Preussischen Regierung dargestellt von J. J. Rein. Erster Band. Natur und Volk des Mikadoreiches, Zweite Auflage. Leipzig: W. Engelmann, 1905. Size 10 × 6½, pp. xiv. and 750. *Maps, Plans, and Illustrations. Presented by the Author.*

This has been thoroughly revised, and embodies the results of recent Japanese research in geology and other branches of science.

Turkey. **Azoury.**

Le Réveil de la Nation Arabe dans l'Asie Turque. . . . Par Negib Azoury. Paris: Plon-Nourrit et Cie., [1905]. Size 7½ × 5, pp. 258. *Portrait. Price* 3.50*fr. Presented by the Author.*

Traces the recent development of a national Arabian party, and discusses its probable influence on the political, religious, and economic future of the near East. The writer points out that it is only by the help of Arabian soldiers that the other populations subject to the Turks are kept in check, and thus shows the immense importance for the Eastern question of the possible rise of an independent Arab power.

Turkey—Arabia. **Hadji Khan and Sparroy.**

With the Pilgrims to Mecca. The Great Pilgrimage of A.H. 1319; A.D. 1902. By Hadji Khan and W. Sparroy. With an Introduction by Prof. A. Vambéry. London and New York: J. Lane, 1905. Size 9 × 6, pp. 314. *Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

This book includes the substance of a series of articles published in the *Morning Post*, but contains in addition much new matter. Prof. Vambéry considers that it supplies the need, that has hitherto existed, "of an account of the Haj, written by a Mohammedan who is not attracted by curiosity, but by religious piety, who had free access to every place, who is not hampered by fear of being discovered as a Christian, and who is, besides, a shrewd observer." The first-named author, though a Musulman, has had a thorough English education.

AFRICA.

Algeria. *C. Rd.* **139** (1904): 1235–1237. **Lamothe**

Les anciennes lignes de rivage du Sahel d'Alger. Note de M. le Général de Lamothe.

This has been referred to elsewhere (*ante*, p. 214).

Algeria. *Rev. G.* **28** (1904): 339–349. **Normand.**

L'Extrême-Sud Oranais (Etude de Géographie militaire). Par Capitaine R. Normand. *Map and Illustrations.*

British Central Africa—Meteorology. ———

British Central Africa Protectorate. Results of Nyasaland Meteorological Observations for the year 1904. Prepared by the Scientific Department, Zomba. Size 13½ × 8½.

British East Africa. ———

Africa. No. 15 (1904). Report on the East Africa Protectorate for the year 1903–4. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 50. *Price* 5½*d.*

British East Africa. **Eliot.**

The East Africa Protectorate. By Sir C. Eliot, K.C.M.G. London: E. Arnold, 1905. Size 9 × 6, pp. xii. and 334. *Maps and Illustrations. Price* 15*s. net. Presented by the Publisher.* [To be reviewed.]

British East Africa and Uganda. **Powell-Cotton.**

In Unknown Africa: a Narrative of Twenty Months' Travel and Sport in Unknown Lands and among New Tribes. By Major P. H. G. Powell-Cotton. London: Hurst & Blackett, 1904. Size 9 × 6, pp. xxiv. and 620. *Maps and Illustrations. Price* 21*s. Presented by the Publishers.* [To be reviewed.]

East Africa. **Schillings.**

Mit Blitzlicht und Büchse. Neue Beobachtungen und Erlebnisse in der Wildnis inmitten der Tierwelt von Aequatorial-Ostafrika. Von C. G. Schillings. Zweiter Abdruck. Leipzig: R. Voigtländer, 1905. Size 10 × 7, pp. xvi. and 558. *Illustrations. Price* 14*m. Presented by the Publisher.*

Contains a most striking series of photographs of living animals of every kind, taken in their natural surroundings. Some were taken by night by the aid of the flashlight, and include several examples of lions in the act of springing on their prey.

Egypt. **Steindorff.**

Durch die Libysche Wüste zur Amonsoase. Von G. Steindorff. (Land und Leute, herausgegeben von A. Scobel. XIX.) Bielefeld und Leipzig: Velhagen & Klasing, 1904. Size 10½ × 7, pp. 164. *Map and Illustrations. Price* 4*m.*

Egypt—Suez Canal. **Ungard.**

Der Suezkanal, seine Geschichte, seine Bau- und Verkehrsverhältnisse und seine militärische Bedeutung. Von Albert Ungard Edler von Öthalom. Wien und Leipzig. A. Hartleben, 1905. Size 9½ × 6½, pp. viii. and 104. *Maps and Profile. Price* 4*s.*

Eritrea. **Perini.**

Magg. R. Perini (Gabrè-Negùs). Di qua dal Marèb (Marèb-mellàsc'). Firenze: Tip. Cooperativa, 1905. Size 10 × 7, pp. 464. *Maps. Presented by the Author.*

A detailed study (intended to supplement the account of Werner Munzinger) of the portion of Eritrea immediately to the north of the Mareb, where the author was stationed for some years. There is also an introductory chapter dealing in a general way with the characteristics of this part of Africa. A good map is given, on the scale of 1 : 500,000, as well as a facsimile of the map (itself mainly based on that of Ludolf) given with Legrand's edition of Lobo.

Rhodesia. **Hall.**

Great Zimbabwe, Mashonaland, Rhodesia. An account of Two Years' Examination Work in 1902–4 on behalf of the Government of Rhodesia. By R. N. Hall. With an Introduction by Prof. A. H. Keane, LL.D. London: Methuen & Co., [1905.] Size 9 × 6, pp. xliv. and 460. *Map, Plans, and Illustrations. Price* 21*s. net. Presented by the Publishers.* [To be reviewed.]

Tunis and Algeria. **Loth.**

Le peuplement Italien en Tunisie et en Algérie. Par G. Loth. Paris: A. Colin, 1905. Size 10½ × 6½, pp. 502. *Maps and Illustrations. Price* 10 *fr. Presented by the Publisher.*

An inquiry into the causes and probable results of the constantly increasing

Italian immigration into Algeria and Tunis, which the author considers as not dangerous to France.

NORTH AMERICA.

Canada. **Johnson.**

Louisiana Purchase Exposition, 1904. Canada: its History, Productions and Natural Resources. Prepared by G. Johnson, D.C.L. Ottawa: Department of Agriculture of Canada, 1904. Size 9 × 6, pp. 176. *Maps and Illustrations.*

Canada. *Appalachia* 10 (1904): 373-383. **Tewes.**

In the Southern Waputehks. Mount Daly—Takakkaw Glacier and Fall—Lower Yoho Canyon. By E. Tewes. *Illustr.*

North America. **Deckert.**

Nordamerika. Von Dr. Emil Deckert. (Allgemeine Länderkunde . . . herausgegeben von Prof. Dr. Wilhelm Sievers. Zweite . . . Auflage.) Leipzig und Wien: Bibliographisches Institut. 1904. Size 10 × 7, pp. xii. and 608. *Maps, Plates, etc. Price* 16*m.*

During the interval which has elapsed since the publication of the first edition, the author has added extensively to his personal knowledge of North America, and has likewise fully availed himself of the abundant material supplied by the various Government departments in the United States and Canada, as well as other sources of knowledge. The value of the work has thus been greatly enhanced.

United States—Maryland. ———

Maryland Geological Survey, Miocene. Text and Plates. Baltimore, 1904. Size 10½ × 7, pp. clvi. and 544. *Maps and Plates. Presented by the Maryland Geological Survey.*

POLAR REGIONS.

Antarctic—Belgian Expedition. ———

The Belgian Antarctic Expedition, under the command of A. de Gerlache de Gomery. Summary Report of the Voyage of the *Belgica* in 1897-1898-1899. Brussels, 1904. Size 11 × 7, pp. 70. *Maps and Illustration.*

Apparently a translation of one of the parts of the 'Résultats du Voyage du S.Y. *Belgica*,' still in course of publication.

Antarctic—Swedish Expedition. **Nordenskjöld and Andersson.**

Antarctica; or, Two Years amongst the Ice of the South Pole. By Dr. N. Otto G. Nordenskjöld and Dr. J. G. Andersson. London: Hurst & Blackett, 1905. Size 9½ × 6½, pp. xviii. and 608. *Maps and Illustrations. Price* 18*s. net. Presented by the Publishers.* [To be reviewed.]

Spitzbergen—Historical. **Conway.**

Early Dutch and English Voyages to Spitzbergen in the Seventeenth Century, including Hessel Gerritsz.: 'Histoire du pays nommé Spitsberghe,' 1613, translated into English, for the first time, by Basil H. Soulsby, of the British Museum; and Jacob Segersz. van der Brugge: 'Journael of Dagh Register,' Amsterdam, 1634; translated into English, for the first time, by J. A. J. de Villiers, of the British Museum, etc. Edited, with Introductions and Notes, by Sir W. Martin Conway. London: Printed for the Hakluyt Society, 1904. Size 9 × 6, pp. xvi. and 192. *Maps. Presented by the Hakluyt Society.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Branner and Newsom.**

Syllabus of a Course of Lectures on Economic Geology. By J. C. Branner, PH.D., and J. F. Newsom. Second Edition. Stanford University, 1900. Size 9½ × 6, pp. 368. *Diagrams and Sections. Presented by Dr. J. C. Branner.*

Geology. **Merrill.**

A Treatise on Rocks, Rock-weathering and Soils. By G. P. Merrill. New York: the Macmillan Company, 1904. Size 9 × 6, pp. xx. and 412. *Illustrations. Price* 17*s. net. Presented by the Publishers.*

Brings together the results of several years' study of the phenomena attendant upon rock degeneration and soil formation, which, the author thinks, have been somewhat neglected, in the attention given to the structure and origin of rocks. The subject is a branch of geology possessing a special interest to the physical geographer.

Glacial Epoch. *G.Z.* 10 (1904): 593–600. **Meyer.**
Die Eiszeit in den Tropen. Von Prof. Dr. H. Meyer.
Noticed in the Monthly Record for March, p. 333.

Landscape. **Geikie.**
Landscape in History, and other Essays. By Sir A. Geikie. London: Macmillan & Co., 1905. Size 9½ × 6, pp. viii. and 352. *Price 8s. 6d. net. Presented by the Publishers.*

A collection of essays and addresses on various subjects connected with Physical Geography and allied sciences, presenting the same charm of thought and diction which characterize the author's previous writings. The first three deal with Landscape in its relations to History, the Imagination and Literature. Others deal with the origin of the Scenery of Britain, the Huttonian Theory, Geological time, etc.

Magnetic Declination. *Deutsch. G. Blätter* 27 (1904): 158–175. **Wolkenhauer.**
War die magnetische Deklination vor Kolumbus erster Reise nach Amerika tatsächlich unbekannt? Von Dr. A. Wolkenhauer.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography—Man and Weather. **Dexter.**
Weather Influences. An Empirical Study of the Mental and Physiological effects of definite Meteorological Conditions. By E. G. Dexter, PH.D. With Introduction by Cleveland Abbe, LL.D. New York: the Macmillan Co.; London: Macmillan & Co. 1904. Size 9 × 6, pp. xxxii. and 286. *Diagrams. Presented by the Publishers.*

Historical—Early Travels. **Purchas.**
Hakluytus Posthumus or Purchas His Pilgrimes Contayning a History of the World in Sea Voyages and Lande Travells by Englishmen and others. By Samuel Purchas, B.D. Vols. i. and ii. Glasgow: J. MacLehose & Sons, 1905. Size 9 × 6, pp. (vol. i.) l. and 504; (vol. ii.) xvi. and 550. *Map and Portraits. Price 12s. 6d. net per volume. Presented by the Publishers.*

The first two volumes of a reprint of Purchas, produced in the same fine style as the same publishers' edition of Hakluyt. It is not quite easy to see the motive for issuing the two series in precisely the same binding, a practice which, in the eyes of many, swamps the individuality of the separate works, but it is probably a concession to popular taste. All the original maps and plates will be reproduced, though, curiously enough, there is nothing to show the unlearned (in the case of most of the plates) that they are taken from Purchas.

BIOGRAPHY.

Biographical Dictionary. **Poggendorff.**
Biographisch-Literarisches Handwörterbuch zur Geschichte der Exacten Wissenschaften . . . gesammelt von J. C. Poggendorff. 4 vols. (Dritter Band (1858 bis 1883), herausgegeben von Dr. B. W. Feddersen und Prof. Dr. A. J. von Oettingen.) Leipzig: J. A. Barth, 1863–1904. Size 10 × 6½, pp. (vol. i.) viii. and 1584 cols.: (vol. ii.) 1468 cols.; (vol. iii.) viii. and 1496 pp.; (vol. iv.) xii. and 1718 pp.

This invaluable work of reference has, after an interval of twenty years, been once more brought up to date by the issue of a fourth volume comprising the period 1883–1904. Although here and there omissions are noticeable, the laborious work of compilation seems on the whole to have been carried out with great thoroughness. The space devoted to the last twenty years is, of course, relatively far greater than ever before.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Scarborough.**
Scarborough's Map of England and Wales, showing Geographical Counties and Boroughs, all Railways and Steamship Lines, with Distances between Stations and Landings. Scale 1 : 633,600 or 10 stat. miles to an inch. *Price 12s., mounted on rollers and varnished.*—Scarborough's Map of Scotland, showing Counties, all Railways and Steamship Lines, with Distances between Stations and Landings. Scale 1 : 443,520 or 7 stat. miles to an inch. *Price 15s., mounted on rollers and*

varnished. Boston and London: The Scarborough Company. *Presented by the Publisher.*

The Scarborough Company are issuing maps of European countries upon the same lines and in the same style as their American series. The two mentioned above, if not artistic productions, will certainly be useful to commercial men and travellers. Railways seem to have received special attention, as is the case with the American series. No serious attempt has been made to show hill features, although isolated hills are indicated here and there. A table of distances and an index to places is given on each map. The maps are varnished and mounted on rollers.

Crete. **Mpikaki.**

Map of Crete. By A. I. Mpikaki. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Athens; D. K. Kokkinakis, 1905. [In Greek.]

A roughly executed general map of the island, with ancient sites in red.

England. **Bartholomew.**

Bartholomew's New Reduced Survey of England and Wales. Scale 1 : 126,720 or 2 stat. miles to an inch. Aldershot District. Edinburgh: John Bartholomew & Co., [1905]. *Price 2s. net. Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1905.

6-inch—County Maps (first revision):—

Brecknockshire, 8 N.E. **Cambridgeshire**, 1 S.W., S.E., 3 N.E., S.E. **Gloucestershire**, 11 N.E. **Herefordshire**, 5 S.E., 10 N.W., 20 N.W., 24 S.W., 26 N.W., 27 N.E., S.W., 28 N.W., 31 N.E., S.E., 32 N.W., N.E., 33 N.W., S.W., 34 S.W., 47 S.E., 52 N.W., N.E., 54 N.W. **Leicestershire**, 3 N.W., S.W., 8 S.W., 14 N.E., 18 N.W., 47 S.W. **Lincolnshire**, 113 N.W., S.W., 122 S.W., 130 N.E., 139 S.W., S.E., 146 S.W., 150 N.E., S.E. **Radnorshire**, 17 S.W., S.E., 18 N.W., S.E., 24 N.W., S.W., 25 N.W., 27 N.E., 28 S.W., S.E., 32 N.E., 33 N.W., 34 S.W. **Rutland**, 3 S.W., S.E., 7 S.W., 9 S.E., 10 N.W., N.E., S.E., 14 N.E., S.W., 15 N.E., S.W. **Somerset**, (7 N.W. and S.W.), 50 S.W., 60 S.E., 70 N.W., N.E., 79 N.E., S.E. **Staffordshire**, 69 S.W., 72 N.E., S.E. **Suffolk**, 80 N.W. **Warwickshire**, 8 S.W., 9 S.E., 18 N.E., S.E., 16 N.E. **Worcestershire**, 5 N.E., S.E., 16 S.W., 27 S.E., 28 S.E., 54 N.E. **Yorkshire** (first revision of 1891 Survey), 287 N.E. 1*s. each.*

25-inch—County Maps (first revision):—

Brecknockshire, I. 16; IV. 3, 4, 6, 7, 8, 10, 11; VII. 4, 10, 13, 14, 15, 16; VIII. 2, 6, 9, 10, 13, 14; X. 2, 3, 4; XI. 1, 2; XX. 1. **Cardiganshire**, II. 9, 10, 13, 14; III. 2, 3, 7, 10, 11, 16; IV. 1, 2, 5, 6, 9, 10, 11, 12, 15; VII. 1, 2, 3, 4, 5, 6, 7, 11. **Carmarthenshire**, XIX. 1. **Devonshire**, IVA. 2, 10, 14; XVIII. 14; XXVIII. 2, 3, 4, 12; XXIX. 1, 5; XXXI. 1, 3, 4, 5, 6, 7, 9, 10, 11, 12; XLIV. 14, 16; XLV. 3, 7, 9, 13, 14, 15, 16; LV. 2, 7, 10, 11, 15; LVI. 6, 11, 13; LVII. 1, 9; LXVIII. 9; LXIX. 8, 12, 13, 15, 16; LXX. 10; LXXXI. 12, 14, 15; LXXXII. 1, 5, 13; XCIII. 2, 6, 8, 10, 12; XCIV. 5, 13; **Herefordshire**, VIII. 15; XIII. 2, 3, 8, 10 (11 and 7), 12; XIV. 5, 6, 7; XXI. 8. **Lincolnshire**, CIV. 1, 2, 3, 4, 6, 7, 8, 11, 12, 13, 15; CXV. 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16; CXVI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15; CXVII. 1, 2, 3, 4, 5, 7, 9, 10, 11, 13, 14, 15; CXXVIII. 5, 6, 9, 10, 11, 13, 14, 15. **Norfolk**, XCI. 7; XCII. 5, 6, 7, 8, 9, 11, 12, 13, 15, 16; XCIII, 5, 6, 12, 14, 15, 16; CII. 4, 7; CIII. 15; CIV. 6, 10, 11, 14, 16; CV. 9, 10, 14: CVI. 5, 9; CIX. 1, 4; CX. 1, 3, 4, 6. **Radnorshire**, XIV. 1, 4, 8, 11, 12, 14, 15, 16; XXI. 3, 4, 6, 7, 10, 11. **Suffolk**, VI. 13, 15, 16; VII. 14, 15; XII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XIV. 15; XXIV. 1, 4; XXV. 1, 6; XXXI. 3, 4. **Warwickshire**, XIV. 2, 6; XXI. 13, 14; XXII. 12; XXIII. 10, 15; XXV. 1, 4, 5, 6, 8, 10, 11, 12; XXVI. 1, 2, 3, 5, 6, 7, 9, 11; XXXI. 2, 5; XLIII. 13; XLIX. 1, 2. **Worcestershire**, XVIII. 12, 16; XIX. 9, 13; XXIV. 2, 5; XXV. 4, 8; XXVI. 6, 7, 8; XXXVI. 13; XXXIX. 12; XLIII. 1, 2. **Yorkshire** (first revision of 1891 Survey), CCLXXXVIII. 6, 10. 3*s. each.*

England and Wales. **Geological Survey.**

1-inch map (New Series). Colour printed.

Bournemouth, 329; Swanage, 343; Drift editions. 1*s.* 6*d. each.*
(E. Stanford, London Agent.)

Europe. **Bartholomew.**

Bartholomew's Railway and Steamship Map of Europe and the Mediterranean. From latest surveys. By J. G. Bartholomew, F.R.S.E. Scale 1 : 5,448,960 or 86 stat. miles to an inch. Edinburgh: John Bartholomew & Co., [1905]. *Price 2s. net. Presented by the Publisher.*

Finland. **Inberg.**

Karta öfver Storfurstendömet Finland. Af I. J. Inberg. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. 4 sheets. Helsingfors: F. Tilgmann.

This map has evidently been reduced by photography from drawings on a larger scale, with the result that the lettering is so small in places as to be almost illegible without a glass. However, it is a good, useful map for general reference, containing a great deal of information. It is printed in colours. A useful table of distances between places in Finland is given as an inset.

France. **Lang.**

Schulwandkarte des Kriegsschauplatzes 1870–71 und der wesentlichen kriegerischen Begebenheiten. Scale 1 : 350,000 or 5·5 stat. miles to an inch. Third edition. 4 sheets. Leipzig: George Lang.

Ireland. **Bartholomew.**

Bartholomew's "Quarter-inch to Mile" Map of Ireland. Reduced by permission from the Ordnance Survey. Sheets: 1, Donegal and Enniskillen; 3, Connemara and Sligo. Edinburgh: John Bartholomew & Co., [1905]. *Price 2s. net each sheet. Presented by the Publishers.*

With the publication of these two sheets Bartholomew's "Quarter-inch to Mile" map of Ireland is complete. There are altogether seven sheets, of which the first to be issued was noticed in the *Geographical Journal* for June last. In general appearance the sheets resemble the well-known maps of England and Scotland, which have deservedly gained a wide reputation amongst tourists and others, except that some of the tints employed in the orographic shading have been improved from an artistic point of view, especially the greens.

Vistula. **Petermanns Geographische Mitteilungen.**

Die Veränderung im Mündungsgebiet der alten Danziger Weichsel in den letzten drei Jahrhunderten. Reduziert nach der Karte der Königl. Preussischen Geologischen Landesanstalt 1903. Scale 1 : 30,000 or 2·1 inches to a mile. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 4. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

ASIA.

Asia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1 : 1,168,031 or 18·4 stat. miles to an inch. Sheet VIII. bis, Nikolaievsk. St. Petersburg: Military Topographical Department, 1903. [In Russian.]

This sheet includes the mouth of the Amur and the northern part of the island of Sakhalin.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Von Dr. Richard Kiepert. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Sheet D ii. Adalia. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Price 6m.*

The eastern and southern sheets of this map are now published, and all that remains of the twenty-four sheets comprising the complete map are the eight western sheets. Since the publication of the eastern sheets a considerable amount of additional cartographical information has been obtained, which will render revision of this part most desirable.

Manchuria. **Topographical Section, General Staff.**

Map of Country round Mukden to illustrate the Campaign in Manchuria. Reproduced from the Russian Staff Map, 1904. Scale 1 : 420,000 or 6·6 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price 2s.*

AMERICA.

Canada—Ontario. **Scarborough.**

Scarborough's Map of Ontario, with an Index of all Cities, Villages, Post Offices, and Railway Stations, and population according to the 1901 Census. Based upon the latest Government Surveys and Explorations. Scale 1 : 950,400 or 15 stat. miles to an inch. Boston and London: The Scarborough Company. *Presented by the Publishers.*

A useful map containing much information. One of the important features is the numerous notes upon the map concerning the character of the country, giving particulars of physical features, forests, and land suitable for agriculture. There is a useful index, and a table of distances between all important places. The map is mounted on rollers.

United States. **Scarborough.**

Scarborough's Map of California. Scale 1 : 887,040 or 14 stat. miles to an inch. Scarborough's Topographic Map of Massachusetts. Scale 1 : 205,920 or 3·2 stat. miles to an inch.—Scarborough's New Railroad, Post Office, Township and County Map of New York. Scale 1 : 475,200 or 7·5 stat. miles to an inch. Boston and London: The Scarborough Company. *Price $5 each, mounted on rollers and varnished. Presented by the Publishers.*

These form part of a series of useful commercial and general maps of the United States, which are now in course of publication by the Scarborough Company. The scale upon which they are drawn is sufficiently large to permit of a considerable amount of useful information being given, and great care has been taken to bring them up to date as far as possible. There are inset maps and plans of important centres, and upon each is a useful table of distances between places, and an excellent index. The maps are highly coloured and mounted on rollers. Hardly any attempt has been made to show relief, and the execution throughout is decidedly rough. Still, for commercial and travelling purposes the maps will doubtless be of service.

ATLANTIC OCEAN.

Atlantic Ocean. **Stanford.**

The Autograph Hand-maps: The Atlantic Ocean on Mollweide's Equal Area Projection. Oxford: William Stanford & Co. *Price* 1*d. net. Presented by the Publishers.*

An outline only of a diagrammatic character.

PACIFIC OCEAN.

Guam Island. **Petermanns Geographische Mitteilungen.**

Insel Guam (Marianen). Nach den amerikanischen Aufnahmen 1901–1902 reduziert nach der Karte des Hydrographischen Amts in Washington 1904. Scale 1 : 225,000 or 3·5 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 3. Gotha: Justus Perthes, 1905. *Presented by the Publishers.*

GENERAL.

World. **Philip.**

Philips' Elementary Atlases of Comparative Geography. Edited by George Philip, F.R.G.S. Birmingham and Midlands Edition. Northumberland Edition. London: George Philip & Son, Ltd. *Price* 1*s. net. each. Presented by the Publishers.*

In their main features and general maps these two school atlases are similar, the difference being that the "Northumberland edition" contains special maps of northern England and Northumberland, and a plan of the Tyneside ports; whilst the "Birmingham and the Midlands edition" gives special maps of Central England, the Midlands, the Birmingham District, and the Potteries. The arrangement of preparing separate editions for special localities has much to commend it from an educational point of view, and the atlases will doubtless find their way into many of the elementary schools of the respective districts for which they are intended, especially as they can be obtained for one shilling. The physical maps indicate the relief by orographical colouring in combination with hill shading, and if somewhat rough in appearance, the maps are clear and not overcrowded.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich herausgegeben von Justus Perthes Geographischer Anstalt in Gotha. 41 und 42 Lieferung. Gotha: Justus Perthes, [1905].

These two parts, which are in one cover, contain the following maps: No. 5, North Polar Regions, by H. Habenicht, scale 1 : 20,000,000; No. 6, South Polar Regions, by H. Habenicht, scale 1 : 40,000,000; Nos. 11 and 12, sheets 3 and 4 of a map of Germany, by C. Scherrer, scale 1 : 1,500,000.

CHARTS.

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Chart, No 100, Bahia Tongoi. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Valparaiso: Oficina Hidrografica, Marine de Chile, 1904. *Presented by the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for March, 1905. London: Meteorological Office, 1905. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for March, 1905. Washington: United States Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

India. **Yate.**

Four photographs of an old Mahommedan Cemetery near Malir, 18 miles north-east of Karachi, India. Taken by Lieut.-Col. A. C. Yate. *Presented by Lieut.-Col. A. C. Yate.*

Colonel Yate, in a note forwarded with these photographs, states that this cemetery is about 150 years old, and is situated near the head of the Malir waterworks, which supply all Karachi with water. Nothing seems to be known definitely of its origin, but according to native tradition the tombs are those of Baluchis slain in battle. Colonel Yate is, however, inclined to believe that the central domed tomb is that of some holy man of Islam, around whose shrine the faithful have brought their dead for burial.

Kashmir and Tibet. **Charrington.**

Eighty photographs of Kashmir and North-West Tibet, taken by Lieut. S. H. Charrington, 15th Hussars. *Presented by Lieut. S. H. Charrington.*

An interesting series of small photographs taken on a journey from Leh through Baltistan to the frontier regions of Western Tibet during the summer of last year. The following are the titles:—

(1 and 2) The Sind river at Sonamarg; (3) View from Sonamarg; (4) Baggage ponies grazing at Sonamarg; (5) Leh from the south-east; (6) Main street, Leh; (7) Leh bazaar; (8) Loading up at Leh; (9) Marsimik La, Ladakh; (10) Tsokr Chumo lake; (11) Camp at Pomlung, Ladakh; (12) Chimray lamasery; (13 and 14) Chang La; (15) Crossing the Chang La; (16) Ladakhis from Tankse who accompanied the caravan; (17) Ladakhi women near Tankse; (18) Upshi village; (19) Gya village; (20) Strata between Gya and Miru; (21) Zoji La; (22) A "yakh" on the Shiok river; (23) Inflating a "yakh"; (24) Crossing the Shiok river on a "yakh"; (25) Tent at Tang, Shiok valley; (26) Shiok river above Tang; (27) Ibex ground, La-onchon, Shiok river; (28) View from the top of Waris pass, Shiok valley; (29) Nubra Rajah's palace, Charasa; (30) Nubra Rajah's palace from near Taggar; (31) Large "mani" rocks at Kubet; (32) Bridge over the Shiok river; (33) Kardong La from the north; (34) Descending north side of Kardong La; (35) Looking towards Leh from Kardong La; (36) Pamzal, Chang-Chenmo; (37) View east from Kiam, Chang-Chenmo; (38) Camp 4 miles east of Piwuk; (39) Pangong lake; (40) Camp, Garm-pani; (41) Base camp at Tab-mar-marvo; (42 and 43) Bukshen glaciers, from Tab-mar-marvo; (44 and 45) Panorama of Herpa Tso; (46) Camp south of Herpa Tso; (47) Yak ground south of Herpa Tso; (48) Camp 8 miles east of Herpa Tso; (49) View south from camp at Lanak; (50) Camp below Lanak La; (51) Tibet from the Lanak La; (52) Bharal; (53 and 54) *Ovis Hodgsoni*; (55 and 56) Goa; (57) Herd of wild yak; (58) Solitary bull yak; (59) Kyang; (60–62) Tibetan antelope; (63) Salt lake, No. 2; (64) Caravan returning from Tibet; (65) Kipalu, Baltistan; (66) Rajah of Kipalu's two brothers; (67) Poplar avenue at Kiris; (68) "Yakh" at Kipalu; (69) Prahnu, Baltistan; (70) Paxfain, Baltistan; (71) Nullah above Sermik, Baltistan; (72 and 73) Shiller pass on to the Deosai plain; (74 and 75) The Gilgit road; (76) Marpanon, on the Gilgit road; (77) Bridge No. 6, Srinagar; (78) Bridge No. 7, Srinagar; (79) Lamaryuru lamasery; (80) Tiksai lamasery.

Kordofan. **Lloyd.**

Fourteen photographs of Kordofan, taken by Captain W. Lloyd. *Presented by Captain W. Lloyd.*

Few photographs have been taken in Kordofan, consequently these form a welcome addition to the Map Room collection. They are principally types of natives:—

(1–3) Sheik Ismail Mohammed el Sheikh, Nazir of the Asakara section of the Hamar's; (4) Sheikh Mustafa abu Ranat; (5) Beshir bey Kambal, who was with Gordon as a young man; (6) Hamid bey Fatin, Nazir of the Hamar Degagin, was made a bey by Gordon; (7) Sheikh Ali, son of Hamid bey Fatin; (8) Sheikh Salem Bakhri; (9) Iron smelting at Nahud; (10) Egyptian Army transport; (11) Sheikh of Falata's as El Obeid; (12–14) Women of Northern Nigeria on their way to Mecca.

Pamirs. **Mackintosh.**

Ninety photographs of the Taghdumbash Pamir, and the road to it by Gilgit and Hunza. Taken by Captain J. B. Mackintosh, R.A. *Presented by Captain J. B. Mackintosh, R.A.*

These little photographs serve well to illustrate the physical characteristics of the Pamir region, and the route thither from Kashmir. The titles are as follows:—

(1) The Wular lake and valley of Kashmir; (2) Tragbal, near top of Rajdiangau pass; (3) Halfway down Rajdiangau pass, looking towards Gurais; (4) Near Gurais; (5) Gurais; (6) On the Burzil pass; (7) Astore; (8) Ruttu and Mir Malik nullah; (9) Polo in a dust-storm at Ruttu; (10) Rupple bridge and Nanga Parbat in clouds; (11 and 12) The Hatu Pir; (13) The Ramghat bridge; (14) Bunji, on the banks of the Indus; (15) Nanga Parbat from Bunji; (16) Gilgit; (17) Rakapushi; (18) Nilt in the Hunza valley; (19) Minapin, a village in the Hunza valley; (20) Rakapushi from near Baltit, Hunza; (21) Wazir Humayun of Hunza; (22) Humayun, his son, and the British political munshi at Baltit; (23) Coolies leaving Baltit, Hunza; (24) Village of Altit, Hunza valley; (25) Pasu river and end of glacier; (26) On the Batur glacier; (27) Path near Batur glacier; (28) Fort and village of Kaibar, Hunza valley; (29) Hunza river, north of Khaibar; (30) Rope bridge over the Chupersan river; (31–33) A bit of the path; (34) Misgar, the last village on the southern watershed of the Himalayas; (35) Rope bridge at Misgar; (36) Yaks with baggage entering Mispar on return journey; (37) Murkushi; (38) Bun-i-Kotal, looking south; (39) Bun-i-Kotal, looking west; (40) The Kilik pass in Chinese Territory; (41) The first camp on the Pamirs; (42) Riding yaks on side of a hill; (43) West end of Taghdumbash Pamirs; (44) Camp in Kukturruk nullah; (45) First *Ovis poli*, Kukturruk nullah; (46) The Wakhjir pass from Taghdumbash Pamirs; (47) Yaks with *Ovis poli* heads; (48) Khor Kosh Beg, with his wives and family; (49) An encampment of shepherds; (50) Camp in the Khunjerab valley at entrance to Ophrang pass; (51) East end of Ophrang pass; (52) Entrance to Orphrang pass; (53) Head of *Ovis poli;* (54 and 55) Khunjerab pass; (56) General view of Tashkurgan; (57) Russian fort, Tashkurgan; (58–60) Panorama of Tashkurgan; (61) Sher Mahomed; (62) Amban of Sarikol; (63) Captain J. B. Mackintosh, Amban, and Amban's followers; (64) Amban and tumchis; (65) Group of Sarikoli horsemen; (66) Amban and retinue; (67) The Bejik pass; (68) Head of Bejik nullah; (69) Heads of *Ovis poli;* (70) Taghdumbash Pamir; (71) A side valley near Mintaka; (72) Karachnai pass; (73) The top of Karachnai pass; (74) The view from top of Karachnai pass; (75) Entrance to Mintaka pass from Chinese side; (76 and 77) Mintaka pass; (79 End of Kirish glacier and mouth of Mintaka pass; (80) Kirish glacier; (81) On the road to Murkushi; (82) Where the road bifurcates at Murkushi; (83) Shikari; (84) The Jhelum at Srinagar; (85) A canal at Srinagar; (86) On the Dal lake, Srinagar; (87) Gulmarg, the western Marg; (88 and 90) View of Gulmarg; (89) Golf links, Gulmarg.

Tibet. **Landon.**

Twenty-four reproductions of photographs taken during the British Mission to Lhasa, by Percival Landon, Esq. *Presented by Percival Landon, Esq.*

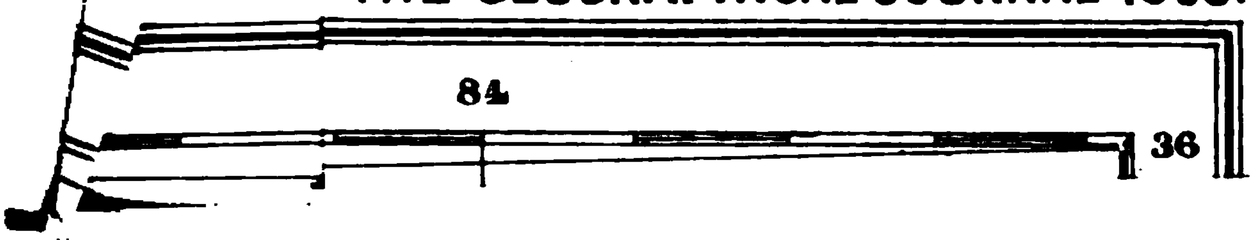
These excellent photographic reproductions are the illustrations in Mr. Landon's recently published book 'Lhasa.' They are remarkably good specimens, and, as will be seen from the titles, the subjects are specially interesting—

(1) Gautso, in the Chumbi valley; (2) Red Idol gorge; (3) Phari Jong; (4) On the glacis of Phari fort; (5) Convoy of yaks passing the Tang La in a blizzard; (6) The glacier lake at the Karo La; (7) Before sunrise on the Karo La; (8) Gobshi; (9) Gyantse Jong; (10) The iris wood at Gyantse; (11) The Tibetan wall at the Hot Springs; (12) A Tibetan sanctuary; (13) On the Rong Li; (14) Evening by the Kyi Chu; (15) Outside the western gate of Lhasa; (16) Pargo Kaling, the western gate of Lhasa; (17) The view inside the western gate of Lhasa; (18) The Potala Palace; (19) The entrance to the cathedral of Lhasa; (20) The chief magician's temple at Lhasa; (21) The throne of the chief magician, Lhasa; (22) Street scene in Lhasa; (23) In the Lukang gardens at Lhasa; (24) On the Ling-Kor, Lhasa.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

WESTERN TIBET.
RAWLING & HARGREAVES.

THE GEOGRAPHICAL JOURNAL 1905.



The

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THE GEOGRAPHICAL RESULTS OF THE TIBET MISSION.*

By Sir FRANK YOUNGHUSBAND, K.C.I.E.

Though I shall tell to-night of a journey to the "Forbidden City," there is, I fear, little, strictly speaking, new that I shall have to say. My companions and myself were, indeed, the first Europeans to enter Lhasa for many years. Still, we cannot claim credit for having been the first of all, and all I can do is to corroborate and emphasize the work of former travellers, and especially of those hardy Indian explorers A-K, Sarat Chandra Das, and others, who had made such careful surveys and interesting notes that some at least of our obstacles were removed.

Such corroboration is, however, very necessary, for an impression had of recent years grown up in Europe that Tibet was a wretched, poor, inhospitable country; and this is not what those few travellers, European and Indian, who had been to Lhasa before had described, nor is it actually the case. The northern part of Tibet, which is all that recent European travellers have seen, is indeed barren, uncultivated, and worthless, and this forms quite two-thirds of the whole. But Tibet is a large country—as large as the provinces of Bombay, Madras, and the Punjab put together, and there is a third part still remaining which is remarkably well cultivated, which is dotted over with thriving villages and the well-built and comfortable residences of the Tibet gentry. Taking it as a whole, then, and excluding the worthless desert portion, Tibet is probably fully as rich as Kashmir or Nepal. The valleys in which Lhasa, Gyantse, and Shigatse are situated, and the valley of the Brahmaputra, are neither barren plateaux nor yet narrow V-shaped gorges. They are flat valleys from 4 or 5 to as much as 10

* Read at the Royal Geographical Society, February 13, 1905. Map, p. 588.

miles broad, covered with good soil, well irrigated, and richly cultivated. This is the most important geographical fact which, though mentioned casually by former travellers, we were able to re-establish and confirm.

And with this fact clearly impressed upon your minds, let me now ask you to follow in the footsteps of the Tibet Mission in its journey from India to Lhasa. We unfortunately had to take our bodies there, and for the human body Tibet and Sikkim, through which we had to pass on the way into Tibet, are at certain seasons anything but attractive. You, however, need go there in mind only, and for the mind I do not know, in the whole realm of nature, any greater glories than Sikkim and Tibet afford. At the very outset of our travels was the sight which in all the world I consider the supreme—the view of Kinchenjunga from Darjiling, described by many travellers before, but by none better than by Mr. Douglas Freshfield in his recent book on this region. We had then to pass through as superb tropical forests as are anywhere to be met with, and, emerging on to the high Tibetan tableland, it was our good fortune to live for a month in full view of the magnificent panorama of 150 miles of the highest peaks in the Himalayas, with the loftiest mountain in the world as the culminating object. Lastly, we had ever before us in the dim mysterious distance the Sacred City, of which so little was known, and entrance to which was barred by every obstacle which man and nature could raise; and while my military companions had constantly to think of how best to overcome the resistance we might encounter, we of the political service had continually with us the earnest desire and the ambition to lessen by all our powers of reasoning and persuasion the military resistance, and above all so to impress the people who were now first making our acquaintance, that on our departure their disposition towards us should be one of friendliness rather than hostility, and that they should no longer look upon us as people to be roughly and rigidly excluded, but, on the contrary, respected and welcomed.

What more inspiring task could any men be entrusted with? And while this is not the place to speak of the military and political work of the mission, I may at least say that our objects *were* attained, and I may express my firm conviction that from this time onwards all European travellers will be the gainers for what the British Mission to Lhasa did in 1904. One only evil geographical result I foresee. This Society will have one less destination for the adventurous explorers of Great Britain, and the Sven Hedins of the future, like a fast-expiring race, will be driven back and back till they finally vanish from the Earth amid the Arctic snows. But for this misfortune not we only are to blame, but also and chiefly one of your own Gold Medallists, the great Viceroy of India, to whose initiative the whole enterprise was due, and without whose constant support it could scarcely have been brought to a conclusion so disastrous for future explorers.

Our start from Darjiling in June, 1903, was miserable enough. The monsoon was just bursting, the rain was coming down in cataracts, and all was shrouded in the densest mist. Few knew of the enterprise upon which I was embarking, but a little knot of strangers who had assembled in the porch of the hotel had got an inkling, and shouted "Good luck" as I rode off, covered with waterproofs, into the mist to join my companions, Mr. White and Captain O'Connor, in Sikkim. And detestable though the rain was, there was still a large surplus of joy in riding through those wonderful Sikkim forests, day after day seeing fresh marvels of forest growth or flowery beauty. The mountain-sides were everywhere a wealth of tropical vegetation, rich and luxuriant. And here under the shade of the mighty giants of the forest grew the stately tree-ferns, often 40 or 50 feet in height, with fronds 10 or 12 feet long. All were in bright fresh foliage, and besides ferns of every graceful form and of the subtlest delicacy of tracery were variegated coloured plants, like calladiums, and closely connecting all together and festooned from tree to tree were creepers of every size, from the great elephant creeper whose leaves resembled elephants' ears, to light trailing vine-like tendrils lightly strung from bough to bough; while here and there, as some bright surprise, the eye would light upon the most perfect orchid, or other flowery marvel, which brought one to a halt in an ecstasy of enjoyment. Nor should I omit to mention the brilliant butterflies glinting past on every side. Seventeen different kinds did I count in the space of 200 yards in the Teesta valley; and in few other places in the world are to be found such a variety of rare butterflies, so many different orchids, and such a wealth of trees and flowers as in Sikkim. There are, I believe, over six hundred different orchids alone to be found here, and over sixty separate kinds of rhododendron.

Fain would I dwell longer on the attractions of this wonderful country, but it is with Tibet itself that we are chiefly concerned to-night, and thither I must without delay transport you. Just cross one pass, and all is changed. On the far side of the Kongra-lama pass not a tree is to be seen. If in some secluded nook a plant a foot high is met with, it is a curiosity. In place of the deep-cut valleys of Sikkim there are great plains 10 or 12 miles wide. The sky is cloudless, and the view extended over many and many a mile. Here at Khamba Jong Mr. White had laid out a camp, and here we spent many delightful months, doing our best to bring to reason a people nearly as obstinate as ourselves, and between whiles making roving expeditions to distant valleys, geological investigations with Mr. Hayden of the Geological Survey, botanical trips with Dr. Prain of the Botanical Gardens in Calcutta, natural history expeditions with Captain Walton, I.M.S.; every day and every hour enjoying the charming summer climate, and, above all, the unrivalled panorama of the mighty Himalayas at the very culminating point of their grandeur, where all

the loftiest peaks in the world were majestically arrayed before us. Captain Ryder, known to you for his journey in China, surveyed and measured all this wonderful region, and will, I trust, before long give you full particulars of his surveys. But who will ever be able to adequately describe the fascination of that glorious range of mountains? From sunrise to sunset the days were a continual delight. As I looked out of my tent in the early morning, while all below was still wrapped in a steely grey, far away in the distance the first streaks of dawn would be just gilding the snowy summits of Mount Everest, poised high in heaven as the spotless pinnacle of the world. By degrees the whole great snowy range would be illuminated and shine out in dazzling, unsullied whiteness. Then through all the day it would be bathed in ever-varying hues of blue and purple till the setting sun clothed all in a final intensity of glory, and left one hungering for daylight to appear again.

And all was rendered doubly interesting from the history of its geological past, which Mr. Hayden was able to describe to me. He was indeed enraptured with the district from the geological standpoint, and a bed of fossil oysters he discovered there had more fascination for him than Lhasa itself. He was able, from the oysters, to accurately determine the age of the hills in this part of Tibet. According to him they were "recent," that is to say, not more than two or three million years old, and the main axis of the Himalayas was thoroughly modern, perhaps not more than a few hundreds of thousands of years old. In what to geologists are really ancient times Tibet was below a sea which washed around the base of the Himalayas—a mighty granite ridge which is constantly being protruded upward from the interior of the earth, and ever being worn away by the snowfall on its summit. Never have I been able to see Nature at work on such a mighty scale as here, and when the scientific results of Mr. Hayden's work in this region have been thoroughly investigated, I feel sure they will prove of the highest interest and value.

The mission remained at Khamba Jong from July 7 to December 6, but long before the latter date we had discovered that our political objects would never be obtained until we advanced further into the country. A move on to Gyantse was accordingly ordered, and as a considerable body of troops, under the command of General Macdonald, was to escort the mission, the line of advance was changed on to the Chumbi route.

Winter was now on us, and the difficulties which General Macdonald and his troops had to contend with can hardly be realized in England. But not even the rigours of a Tibetan winter were able to stop the advance of the little force of British and Indian troops.

Early in December we crossed the Jelap la and descended into the Chumbi valley. At Yatung, the trade mart established under the old

THE BAMTSO LAKE AND BHUTAN RANGE.

MOUNT EVEREST FROM KHAMBAJONG.

convention, a wall had some years ago been erected to exclude our trade, and beyond this our traders had so far never been allowed to pass. As we debouched on a bright frosty morning from the pine forest in which we had encamped for the night, we saw this wall built right across the road and high up the mountain-side on either hand. Whether we should have to fight our way through, or whether the Tibetan general would respond to the arguments I had used the previous day and gracefully allow us through, had yet to be proved, and General Macdonald used every military precaution. But, to our relief, we saw the great door in the tower standing open, and we were soon passing peaceably through the gate of Tibet, never, I hope, to be closed against us again.

We then emerged on to the main Chumbi valley, which, though not wide and open like the valleys we afterwards saw in Tibet Proper, is decidedly less steep and narrow than the Sikkim valley. Both in the valley-bottom and on the hillsides there was room enough for comfortable villages and cultivated fields. The people were very well-to-do, and, what was more satisfactory from our point of view, decidedly well disposed. They soon showed themselves to be keen traders, and must have made large fortunes out of us during last year. They are not true Tibetans, but are called Tomos. Nor is their valley, which is on the Indian side of the watershed, considered a part of Tibet Proper, which is looked upon as extending only as far as the mouths of steep gorges we a few days later passed through in the upper part of the valley. The rainfall is only about half that of Darjiling, and the climate in general much superior.

The mission remained three weeks in Lower Chumbi, while military preparations for a further advance were being made; and then in the very depth of winter, on January 8, we crossed the Tang-la, 15,200 feet high, on to the Tibetan plateau again. Never shall I forget that day. Reveillé sounded at the first streak of dawn, and as I looked out of my tent the very spirit of Frost seemed to have settled on the scene. The stars were shooting out sharp clean rays from the clear steely sky. Behind the great rugged peak of Chumalhari the first beams of dawn were showing out, but with no force yet to cheer or warm, and only sufficient light to make the cold more apparent. Buckets of water were, of course, frozen solid. The remains of last night's dinner were a hard solid mass. The poor Sikhs were just crawling out of their tents, so shrivelled with the cold it looked as though, if they shrivelled much more, there would be nothing left of them. The thermometer stood at 18° below zero, or just 50° of frost, and though this is not considered much in Canada and Siberia, and I dare say those who have just returned from the Antarctic would consider it pleasantly warm, I should remind you that 50° of frost at a height of 15,000 feet above sea-level is a very different thing from 50° of frost on the sea-level. At 15,000 feet

where the effort of breathing is a continual drain upon one's strength, the mere weight of the heavy clothes one has to wear in cold weather is a sufficient strain in itself. Any additional effort exhausts one immediately. And if it tries us Europeans, who are more or less inured to cold, how much more distressing must it be to the natives of India! and that they were able to march 15 miles across the pass that day, and spend the rest of the winter, as they had to, immediately on the other side, at a height of but little under 15,000 feet, is, I think, a striking testimony to their powers of endurance and the high spirit which prevails among them. Colonel Hogge and the 23rd Pioneers most willingly faced this ordeal, and by this act of endurance proved once and for all to the Tibetans that their country was no longer inaccessible to us, even in the depth of winter.

Here at Tuna more fruitless parley with the Tibetans ensued. They paid one or two visits to me, and once I rode over with Captains O'Connor and Sawyer to see them amid their own surroundings, to gauge their capacity, and to estimate the strength and direction of the various influences at work among them. It became sufficiently evident to us that the real control of affairs was in the hands of the Lhasa lamas, three of whom, one from each of the three great monasteries at Lhasa, were present on the occasion. The four generals whom we then met were amiable and polite enough. They repeated by rote the formula, "Go back to the frontier." But the impetus to obstruct came from the three lamas, who, with scowls on their faces, remained seated on the ground, showing not the slightest signs of civility or ordinary politeness, and instigating the generals to detain us in the Tibetan camp till we would name a definite date for withdrawal. When I think of their rabid fanatical obstruction on that occasion, and compare it with the almost cordial reception we subsequently had in all the great monasteries and in the most sacred shrines before we left Lhasa, I cannot help feeling that we went a long way towards breaking down that barrier of exclusion which, set up by the lamas for their own selfish ends, has kept away from us a people who, when left to themselves, showed every inclination to be on friendly terms with us and indulge their natural instinct for trading.

But parleying with the Tibetans occupied only an insignificant part of my time at Tuna, and I had ample leisure to enjoy the magnificent natural scenery around us. Immediately before us was an almost level and perfectly smooth gravel plain, which gave a sense of space and freedom, and on the far side of the plain, 10 or 12 miles distant, rose the superb range of mountains which forms the main axis of the Himalayas and the boundary between Tibet and Bhutan. They were an unceasing joy to me, and the sight of them alone was ample reward for all the hardships we had to endure. The sun would strike our tents at about seven in the morning. The sky would generally then

be cloudless save for a long soft wisp of gauze-like haze, and perhaps a few delicate streaks of pink or golden cloud poised motionless on the horizon. And the great snowy mountains, in the early morning when I used to go out and watch them, instead of being sharp, clear, and cold, would be veiled in that blue, hazy, dreamy indistinctness which makes the view of Kinchenjunga from Darjiling so marvellously beautiful, and the hard stern mountains as ethereal as fairyland. The bare brown of the base of the mountains was toned down into exquisite shades of purple and pink, while the white of the snowy summits shaded softly into the cerulean of the sky above. On the plain plump little larks and finches would be scurrying about in search of food. Now and then a little vole would be seen basking in the sun at the mouth of his hole. And over all there reigned a sense of peace and quiet which made it hard to believe that only 10 miles off five of the highest lamas in Tibet were solemnly cursing us and publishing to the people round threats of attack upon our camp.

Nor was every day, nor the whole of each day, of this same peaceful nature. Almost invariably at ten or eleven a terrific wind would arise and blow with fury for the rest of the day. Mighty masses of cloud would come sweeping up from the direction of India. Snow would sometimes fall, and then for two or three days together we would be the sport of a terrific blizzard. The mountains would be hidden, and nothing would be visible but dull masses of fiercely driven snow, as fine and dry as dust, and penetrating everywhere. For days together the thermometer would not rise above 15° even in the middle of the day. Our camp would be the very picture of desolation. It seemed impossible that the poor sentries at night would ever be able to stand against the howling storm and the penetrating snow, or that our soldiers would ever be able to resist an attack from the Tibetans under such terrific circumstances.

Then one morning we would find the snow-clouds had passed away from over us, and see the great peak Chumalhari emerging calm, strong, and irresistible from out of the mass of cloud still tossing wildly round its base. Below all seemed chaos. It was difficult to stand against the driving wind; the dust and the powdery snow were still battling furiously around one and around the base of the mountain, and the birds were driven hither and thither. But towering above all the tumult below, serene and majestic, and looking prouder, loftier, and purer than ever, rose the great peak reverenced even by the unimaginative Tibetans; and above it lay the calm blue sky, illimitable in its restfulness and light—a sky of bright and liquid azure, through which one seemed able to pierce right into heaven itself.

Throughout January, February, and March the bitter winds continued, often accompanied by snow in blinding blizzards, through which the convoys and their escort had to force their way with perhaps

even greater sufferings than fell to us. But gradually, as week by week went by, the temperature rose. The military preparations in rear were completed by General Macdonald, and early in April we marched down to Gyantse. Of the military incidents on the way I will say nothing. It was the deepest disappointment to me that fighting should have been necessitated, and the Tibetan generals were as little anxious for it as I was, but they had impossible orders from Lhasa—orders not to fight, not to negotiate, and not to let us proceed. Unless, therefore, we were prepared to abandon the whole object of the mission, fighting was inevitable.

Arrived at Gyantse on April 11, we found a flat open valley 5 or 6 miles wide, dotted all over with flourishing hamlets and intersected by numerous water-channels. Round each hamlet, along the water-channels, and by the bed of the river were willow and poplar trees just showing signs of bursting into foliage. The banks were covered with masses of iris plants, which later on were to flower out into sheets of purple. The piercing cold of the Tuna uplands was left behind. There was only a slight touch of frost at night, while the days were beautifully fine and bright; and we were looking forward to a restful summer of peaceful negotiation, when suddenly ominous clouds began to collect around us, and early on the morning of May 5 we were awoke by wild shouts and firing, and, looking out of our tents, we saw Tibetans firing into us through a wall only 10 yards off. How Major Murray and his Gurkhas warded off the attack; how Colonel Brander defended the post for nearly two months against the Tibetans, who had now invested us; and how General Macdonald eventually returned with a relieving force, drove back the Tibetans, and captured the jong, has been told elsewhere. Geographically, the important point is that the refusal of the Tibetans to negotiate at Gyantse necessitated our advance to Lhasa. On July 14 we set out, much impeded by heavy rain, and soon set aside the delusion that Tibet is a rainless country. Well on till September we had frequent rain, and the size of the rivers and side streams was quite sufficient evidence that this part of Tibet receives—probably up the Brahmaputra valley—a quite considerable rainfall, say between 20 and 30 inches, at a rough guess.

We crossed the easy Karo-la pass, about 16,000 feet, where Colonel Brander had fought his gallant little action early in May, and the next day debouched on to the most lovely lake I have ever seen—the Yamdok Tso. In shape it was like a rough ring, surrounding what is practically an island; and in colour it varied to every shade of violet and turquoise blue and green. At times it would be the blue of heaven, reflecting the intense Tibetan sky. Then, as some cloud passed over it, or as, marching along, we beheld it at some different angle, it would flash back rays of the deep greeny blue of a turquoise. Anon it would show out in various shades of richest

FROZEN WATERFALL AT DOTHA.

THE YAMDOK TSO.

violet. Often, when overhead all was black with heavy rain-clouds, we would see a streak of brilliant light and colour flashing from the far horizon of the lake; while beyond it and beyond the bordering mountains, each receding range of which was of one more beautiful shade of purple than the last, rose once more the mighty axial range of the Himalayas, at that great distance not harsh in their whitey coldness, but softly tinted with a delicate blue, and shading away into the exquisite azure of the sky. What caused the marvellous colouring of this lake, which even the Tibetans call the turquoise lake, we could none of us say. Perhaps it was its depth, perhaps it was its saline character, or some chemical component of its water. But whatever the main cause, one cause at least must have been the intensity of clearness in the liquid Tibetan sky, so deep and so translucent that even the sky of Greece and Italy would look pale and thick beside it.

For three days we marched along the shores of this beautiful lake, and then we ascended our last pass and looked down on to the Brahmaputra river, and almost upon Lhasa itself. But the sacred city was still left hid. Masses of mountains in range after range were all we could see in that direction, and General Macdonald had still the very serious obstacle of the Brahmaputra river, now in almost its full flood, to overcome before we could reach our goal. The Brahmaputra we found to be divided into numerous channels, but we were able to cross it at a spot where it narrowed to 200 yards, though not without the loss by drowning of the one officer to whom, of all others in the force, our success in reaching Lhasa was due—Major G. H. Bretherton, the chief supply and transport officer. The river rushed in whirling vortices past a cliff, from which Captain Sheppard, R.E., suspended a wire rope to the opposite side, and upon it rigged up a flying ferry. The river valley was from 3 to 5 miles wide, and, like the Gyantse valley, richly cultivated with wheat and barley, dotted over with hamlets, monasteries, well-built and comfortable residences of the great men of the country, and with pleasant groves of poplar, walnut, and even a few peach and apricot trees. The side valleys were also well cultivated, and the hillsides, though bare of trees, were covered with grass, which should afford excellent pasturage for many more sheep and goats than we actually saw there. It was altogether a smiling prospect, and doubts as to the possibility of being able to supply our troops with the necessaries of life, for the year round if required, were at once removed.

I was now met by a variety of deputations, each one of increasing weight and importance, and each more urgent than the last in begging me not to proceed to Lhasa. The Dalai Lama himself even wrote to me, an act of unprecedented condescension on his part; and he sent his High Chamberlain to say that if we went to Lhasa, his religion would be spoilt and he would die. I had to inform him, in reply, of the

delicate and painful position in which I was placed, for if, on the one hand, I went on to Lhasa, I understood that His Holiness would die, while if I stayed where I was I would myself die, as I would undoubtedly have my head cut off if I failed to obey the orders I had received and negotiate the treaty in Lhasa itself. Reluctant as I was to cause the premature demise of the Dalai Lama, I felt I had no alternative, I informed the High Chamberlain, but to proceed to Lhasa.

Expectation was now at its height. Each corner we turned we felt sure we should see Lhasa. We hastened to the top of one rise after another in the hopes of catching the first glimpse. The advance patrols of mounted infantry, on their return, were eagerly questioned. At length, on August 2 we rounded our last corner and saw the golden roofs of the Potala of Lhasa glittering in the distance, and on the following day encamped beneath its walls.

Here in a lovely valley covered with trees, rich with cultivation, and watered by a river as broad as the Thames at Westminster, here hidden away by range after range of snowy mountains, lay the mysterious Forbidden City which no living European had seen before. To many who had supposed, because it was so secluded, it must be a kind of dreamland city, it was, I dare say, disappointing, for it was after all built by men, and not by fairies. Its streets were not paved with gold, nor were its doors of pearls. The streets were, indeed, horribly muddy, and the inhabitants less like fairies than any I have so far seen.

But the Potala, the palace of the Grand Lama, was an imposing massive structure, very solidly built of masonry, and picturesquely perched on a rocky eminence dominating the whole plain and the city at its base. Numbers of the houses in the city were, too, well built and solid, and often surrounded by shady trees. The rock-perched palace and the strange city at its base would be striking anywhere, but set in this beautiful valley, deep in the very heart of the mountains, they gathered an additional impressiveness which all who saw them recognized.

It was, however, more to the inhabitants than to their buildings that I had to devote my chief attention during my stay in Lhasa. All the leading men, both lay and ecclesiastical, here came before me, and with them I reasoned and argued and chaffed day after day and week after week. Appallingly ignorant and inconceivably unbusinesslike they were. No one man had supreme authority or full responsibility to negotiate with me. A council were supposed to be the chief executive authorities, but they could do nothing without the consent of the National Assembly, and they, without any presiding officer to control them or any sense of responsibility, simply censured instead of endorsing what the Executive Council did, while these latter were prohibited from attending meetings of the National Assembly to argue their case in person. A more hopelessly inapt organization for

THE POTALA.

PANORAMA OF LHASA FROM BA-MO-RI.

dealing with a crisis in their foreign affairs it would be difficult to imagine. But ignorant, bigoted, and apparently immovable as they were, they had their good points. They were almost invariably polite, and they were genial. The humblest little joke was enough to set them off laughing, and I do not recall separating at the close of a single interview of all the many we had at Lhasa with any feeling of ill temper. I must confess to a feeling of exasperation sometimes when I reflected that my convention had to be got through in so short a time, and no ray of daylight was for so long visible through the dreary clouds of obstruction; but these poor Tibetans do deserve credit for never having really irritated me. It was, after all, their business to make as good a bargain as they could with me, and pertinacity is a trait which need not be cavilled at. Still, it was heavy, weary work. Eight or ten of them would come together. Each one had to have his say, so that when he returned home he could boast that he had for his part spoken up to the British Commissioner. Each one I listened to patiently, and each one I answered. In this way, as every day produced a few fresh men, I worked through most of the leading men in Lhasa, while Captain O'Connor, whose trials were still greater than mine, tackled even larger numbers in his private room.

On the whole, I formed a low estimate of their mental calibre. It is impossible to regard them as much else than children. My talks with them were not only about the business in hand, but about general affairs and about religion. The Ti Rimpochi, with whom the Dalai lama left his seal in his flight for Lhasa a few days before our arrival, held the chair of divinity in the Gaden monastery, and was universally reverenced as the leading Lama in Lhasa. He was recognized as regent, and was the principal in the negotiations with me. But even he, pleasant, benevolent, genial old gentleman as he was, had really very little intellectual power, and but a small modicum of spirituality. In both he was very distinctly inferior to the ordinary Brahmin in India. He liked his little jokes, and we were always on the best of terms. But he was firmly convinced the earth was triangular. His intellectual attainments did not amount to much more than a knowledge by rote of prodigious quantities of verses from the sacred books. Discussion with him upon the why or the wherefore of things ended in bald quotations from the scriptures, and his religion chiefly consisted in ceremonial. The general run of abbots of monasteries and leading Lamas had even less to recommend them. One monastery at Lhasa contained no less than 10,000 monks, and another had 7000. But I do not think any one saw these monks without remarking what a degraded, nasty, sensual-looking lot they were. It is altogether a mistake to suppose that in Tibet is to be found a pure and lofty form of Buddhism. Buddhism and Chinese civilization certainly have raised the rough tribes who, six or seven centuries ago, inhabited Tibet, into something very much

higher than they were before these appeared. But intellectual and spiritual life is stifled by the rigorous monastic rule. All foreign ideas and individual originality have so far been trampled down. And the result is a people of inflexible rigidity, wholly unable to adapt themselves to altering conditions, and without any intellectual force or spiritual impetus. We sought for, but did not find, the wonderful Mahatmas, who would lead us to more lofty peaks of light and wisdom than ever we had trod before. And while I would not deny that Buddhism has done much to tame and civilize a barbarous race of demon-worshippers in Tibet, I would warn those who would look to Lhasa for any kind of higher intellectual or spiritual guidance, to seek nearer home for what they need. Imbued, as the Tibetans are, with much of that impassive contentment inculcated by Buddha, they are still, to all intents and purposes, demon-worshippers. Their religion is grotesque, and is the most degraded, not the purest, form of Buddhism in existence.

Happily we were able to entirely overcome that feeling of obstruction which the heads of the Tibetan Church had so far shown to outsiders. Through Mr. Wilton's influence with the Chinese officials, and Mr. White's connection of many years' standing with the Tibetan lamas in Sikkim, and his tactful suasion, we were able to gain access to all the monasteries and temples, and, before we left Lhasa, British officers went in and out with as little concern as they would to St. Paul's. I insisted upon having the Convention signed in the Potala, and in the finest hall in it, and once the lamas saw no harm resulted, and we invariably treated them with consideration, they entirely withdrew their obstruction, and when, just before leaving Lhasa, I paid a formal visit to the great cathedral called Jo Khang, I was surprised to find them actually pressing me to come inside the railings and walk round the magnificent image of Buddha—a freedom I have never had accorded me in any temple in India.

I fear I have not sufficient time to adequately describe these monasteries and temples. Outside they were solid and massive, though hardly beautiful. Inside they were weird and quaint, and sometimes grotesque. I carried away with me an impression of immense impassive figures of Buddha for ever gazing calmly and tranquilly downwards, of walls painted with grotesque demons and dragons, of highly decorated wooden columns and roofs, of general dirt and griminess, and of innumerable bowls of butter burning night and day, as candles are burnt in Roman Catholic churches before figures of the saints.

Sooner than I could ever have expected, the Convention was signed, and we prepared for our return to India. Once business had been arranged, the Tibetans were all as happy as possible. No single person was responsible; each had had his say, and if blame had to fall on any one, it had to fall on all, and all equally. But in their heart of hearts

THE POTALA FROM BA-MO-RI.

THE LHASA COUNCIL.

they knew full well that they had got off remarkably cheaply, and they had indeed the grace to acknowledge this. On the morning of our departure the regent came down to our camp and presented images of Buddha to Mr. White and myself, as well as to General Macdonald. He thanked us for saving the monasteries and temples, and in presenting the image of Buddha to me, said, "When Buddhists look on this they put aside thoughts of strife, and think only of peace, and I hope that you, when you look at it, will think kindly of Tibet."

And certainly I left Lhasa with every kindly thought. It was a perfect autumn day; the sun was bright and warm. The valley was looking its prettiest in its autumn foliage. The entire council, with their secretaries, had come a mile down the road to offer us a farewell cup of tea and to wish us God-speed on our journey. Their last words were that they intended to keep the treaty and be friends with us in future. Our hopeless task seemed indeed to have been accomplished and good will to have been established.

And all that has happened since corroborates this impression. The council had willingly given permission for a party of officers to proceed through Shigatse up the Brahmaputra, to Gartok in Western Tibet, and then back to India by Simla. This important expedition was placed in charge of Captain Rawling, who two years ago had made a most successful journey in Western Tibet, while Captain Ryder, R.E., was in charge of the survey. These two officers, with Captain Wood, R.E., and Lieut. E. Bailey as their assistants, have accomplished their arduous undertaking. Though accompanied by only an orderly each, and no armed escort, they have travelled through a thousand miles of Tibet, and been well received everywhere. Captain Ryder has surveyed 40,000 square miles of country, including the whole course of the Brahmaputra from Shigatse to its source, the Mansorawar and adjoining lakes, and the sources of the Indus and the Sutlej, and has proved beyond doubt that no higher mountain than Mount Everest lies at the back of the Himalayas. The party suffered indeed terribly from the cold, their thermometer registering 24° below zero, but they crossed a pass 18,400 feet in height in December, and reached India in safety.

I trust, therefore, you will believe that the Tibet Mission has not been barren in geographical results, and that when you wish exploration work to be done, there are good and trusty men in India ever ready and willing to do it.

Before the paper, the CHAIRMAN (Sir THOMAS HOLDICH): I must first of all express my regret, and yours too, no doubt, that to-night, owing to illness, our President is unable to be present, for this is a notable occasion. We greet Sir Frank Younghusband, not only as a distinguished officer just returned from the successful accomplishment of a most onerous duty, but as an old friend and one of the most distinguished members of this Society. Those of us who can remember the courage and determination with which he accomplished that most notable feat, the crossing

of the ice-bound Moustag mountains between China and India, have always been assured that whenever Sir Frank Younghusband should be called on to undertake some high mission for his country or his Government, he would carry it out bravely, faithfully, and thoroughly. And I could say no more than this if I were to stand here for a week, that he has amply justified our faith in him. And now he is here to tell us the story of the unveiling of Lhasa, that city of ancient, if somewhat threadbare, mysteries beyond the Himalayas, and as we are all equally anxious to welcome him and to hear him, I will at once call on him to give us his address on "The Geographical Results of the Tibet Mission."

After the paper, the following discussion took place:—

The CHAIRMAN: There seems to be quite a considerable number of members of this Society present to-night who are more or less acquainted with the northern hinterland of India, some of whom have even traversed Tibet itself. I hope some of them will favour us with a few remarks on the paper which Sir Frank Younghusband has read to us.

General Sir THOMAS GORDON: As a veteran explorer in Western Tibet and Turkestan of over thirty years ago, I wish to offer my congratulations to the successful leader and his companions of the expedition to Lhasa. Lhasa was always a point of attraction to explorers and travellers. I aspired to go there at one time, but it could not be managed. I will relate an incident connected with this desire of mine to go there. When I returned from the "Roof of the World" in 1874, the late Lord Northbrook, then viceroy of India, invited me to Calcutta, and I there met the famous Jung Bahadur, premier and *de facto* ruler of Nepal, who had come to be invested with the high dignity of the G.C.S.I. He was, of course, much interested in Chinese affairs, and when Lord Northbrook introduced me to him, he asked me much about the expulsion of the Chinese from Eastern Turkestan, and the rise to power of that remarkable man, Yakub Beg, who had established himself there as Amir. He also asked about the doings of Russia there, and our own doings, and remarked that we were a restless but practical people. I took advantage of the opportunity to ask him whether, as Nepal had friendly relations with Lhasa, he could not help me to go there, on which he became rather disturbed and nervous in manner, and said that, though they had a representative there, they had no influence or power. "In fact," he said, "one of our representatives some time ago was badly maltreated by having his nose cut off," and looking very hard at me, he added inquiringly, "You wouldn't like to run that risk?" That finished our conversation on the subject. I again offer my congratulations to Sir Frank Younghusband and his companions on their grand success.

Mr. DOUGLAS FRESHFIELD: I shall not apologize for responding to your invitation to take part in this discussion. It is true that I have never penetrated the real Tibet; but I have stood on Pisgah heights in the debatable land of Lhonak, and looked north and eastwards over the peaks and passes that hide the crops and castles of the Tsangpo valley. And I have long had my eyes on Tibet. More than ten years ago, when one of the honorary secretaries of this Society, I instigated the Council to republish Sarat Chandra Das's narrative of his visit to Lhasa. I mention this fact to-night in order to give the credit that is due to that bold Bengalee. Chandra Das has come in lately for some natural criticism. He is not a trained surveyor. He has, no doubt, some of the defects of his qualities. But it was from his work and Major O'Connor's excellent road-book that I was able to glean the information that enabled me a year ago to give the readers of our *Journal* a sketch of the region about to be entered by the British Mission, which, if it is now open to large additions, requires very few corrections.

Before I turn to the geographical points I wish to raise, I must join General

Gordon in congratulating Sir F. Younghusband on the golden opportunity he has enjoyed and the splendid use he has made of it. We meet here to-night as the members, or the guests, of a Scientific Society. But be as scientific as we may, we cannot expel, or eradicate, the romance of travel. We have come in such unusual numbers to listen to the story of one of the great adventures of our time from the lips of its hero. What more romantic tale has ever been told in this hall than that of the Unveiling of Lhasa? And was there not heroism as great as any displayed in the more summary methods of our Elizabethan adventurers, in the endurance, the patience, the persistence, the tact, the sympathy, the humanity shown by Sir F. Younghusband and his escort in dealing with this strange people?

The March of the Two Thousand to Lhasa will live as an epoch-making event in the history of Asia. Sir F. Younghusband has made it live before our eyes to-night. We have felt half frozen in that months' long bivouac on the wind-swept heights of the Tangla; we have watched the double sunsets of Tibet, east answering to west with responsive fires, reflected in the long reaches of the Turquoise Lake; we have panted to get round that last corner and see the vast bulk of the Potala, the Vatican of Buddhism, towering over the green groves and golden roofs of Lhasa itself.

We may almost have fancied ourselves—I at least have—taking tea within a circle of saffron-robed and red-hatted lamas. Doubtless they were a dilatory, undecided, tedious, tactless folk, sadly to seek in geographical and general knowledge. But they had at least one merit; there is one point on which we can fully sympathize with these Tibetan diplomatists. They thoroughly appreciated the merits of Sir F. Younghusband. They appreciated them so well that their parting request to him was that they might be permitted to invite him, or some other Englishman, to come back from time to time to Lhasa and talk things over with them. "Dîs aliter visum." I may translate, for the benefit of the ladies, "The Cabinet did not see it." There are to be no more tea-parties in the Tibetan Wonderland.

But here I approach the verge of the forbidden land of politics. I must return to geographical detail.

We geographers, and you, sir, perhaps, most of all, are deeply concerned that the unique opportunities for collecting and adding to our knowledge of the Himalaya arising from the late mission should not be lost. We have read with satisfaction of recent explorations in North-Western Tibet, and of the great success which has attended the party sent out under Captain Rawling to Gartok and Simla—of their discovery that we need not correct our text-books by inserting a new highest mountain in the world, and of their vindication of Sir R. Strachey's description of the connection of the Manasarowar lakes. But Sir F. Younghusband has told us that this was only one of three important explorations he had planned. Among the most interesting enterprises left to be accomplished on the face of the globe is the tracing of the course of the Brahmaputra where, in fabled gorges and cataracts, it cuts through the chain of the Himalaya. The party that was to solve this problem was arranged for; it was sanctioned by the lamas; Mr. Needham, in Assam, was prepared to march to meet it. At the last moment the expedition was put off by some one at Simla. We must trust that it has only been delayed; that the full and formal sanction given by the Lhasa authorities will not be wasted, but that since Lord Curzon has returned to India, we shall hear that an expedition which would have not only supreme geographical interest, but also commercial and political importance, will be carried through. There is, surely, a new and strong argument in its favour in the easy success of Captain Rawling.

Another matter of great interest to us here is to obtain the publication of the geographical results of these missions and expeditions. We recognize the military reasons for certain restrictions; but we demur to the lack of discretion that pigeonholes indiscriminately harmless facts, sometimes pigeonholes them so completely that our own officials cannot get at them when they are wanted. It may be right sometimes to lock up large-scale maps. It is wrong, and may be dangerous, to forbid their utilization under reasonable restrictions in the production of small-scale maps and the correction of atlases. For statesmen use atlases as often, if not more often, than large-scale maps.

One more point I must refer to. Chumbi has become a household word during the past few weeks. I am not going to enter here into questions of policy. I must confine myself to facts.

Chumbi is the name of a wooded valley some 20 miles long, a wedge of Tibetan territory running out on the Indian side of the Himalaya. Neither by position nor by its inhabitants, neither geographically nor ethnologically, is it Tibetan. Historically the matter is more complex. Some time early in the last century the Tibetans occupied it, along with other ground lying south of the Himalaya in the basin of the Tista, the nearest river to the west. From all the Tista territory we have expelled them. But in a convention drawn up in 1890 between Great Britain, China, and Tibet, we recognized Chumbi as Tibetan. This convention might have given Tibet a diplomatic title to Chumbi, had it ever come into operation. But it was at once repudiated, and has been steadily disregarded by the Tibetans, and our own Government, consequently, before marching to Lhasa, formally declared their intention to modify its terms. The Secretary of State for India, however, quoted this abortive convention as a ground for upsetting the terms of the treaty negotiated by Sir F. Younghusband. On other grounds it might be inexpedient to argue that Chumbi does not come within the terms of the undertaking volunteered by Lord Lansdowne to the Russian ambassador in November, 1903, not to "permanently occupy" any "Tibetan territory." But that any such pledge should have been given argues, in my judgment, an imperfect appreciation of local and historical facts.

Chumbi is no part of Tibet proper; it is the porch, the gate-house of Tibet, to which Phari is the northern and Yatung the southern door. These doors can never again be wholly closed. There is, I know, vague talk in the air of "sterilizing" Tibet—an unfortunate and unscientific phrase, for how will you sterilize that which you cannot keep hermetically sealed? Tibet faces India; the great river of Tibet flows into India; the barrier of Asia here is the northern desert, not the eastern Himalaya. That chain on the south is a wall, but on the north, to those on the top of the wall, its passes (I use Major O'Connor's phrase) lie over Wiltshire downs. Grasp these facts firmly. When they have become part of public knowledge, they may have a better chance of penetrating to the ears of Cabinet ministers and being recognized in national policy.

Sir Henry Howorth: Perhaps I may be permitted, on behalf of another class than geographers, to add very strong testimony to the extra interest of this quite unexampled journey. I speak, if I may, on behalf of those among whom I have spent many years, who have devoted the best portion of their leisure to trying to illustrate the history and the ethnography of the vast regions of which Tibet is the focus, and which stretch in all directions in a fan-like manner from the Volga to the Eastern sea. May I say just one word in addition to what you have said about the almost tragical fact that our President, who in a literary sense re-discovered Tibet for us, who published those wonderful journals of Manning and his companion which, in recent years at all events, have brought Tibet back to us in a living way, should

not have been here to-night to welcome this most wonderful addition to all our knowledge. And may I say, in addition, that one feels in this room the shade of another great geographer and historian of Central Asia, my old friend and master, Henry Yule, whose heart was in Lhasa, and who wrote according to the materials which were available when he gave us that admirable edition of Marco Polo's Travels. You must understand that, apart altogether from the geographical knowledge that this expedition has brought back to us, it has opened a vast gate in regard to matters of ethnography and history which have been puzzles to some of us for a great time past. The whole of that Mongolian race which occupies the northern steppes of Tibet looks upon Lhasa as its Mekka. I have been asked why it is that these extraordinary nomads, the Mongols, who a few centuries ago overwhelmed the civilization of the whole of the known world, have become so peaceable and helpless and useless as soldiers, apparently the most helpless people that there are now on the face of the Earth. It is because they have been converted by the lamas to their form of Buddhism that two-thirds of their race live in monasteries at this moment. They have become celibates, they have given up their old military life and their rapacious habits, and whatever else has been done by these lamas of Tibet, they have succeeded in converting the most extraordinarily aggressive race that the world has probably ever seen into one of the most peaceful and the most quiet. Here from the Volga, where you have the Kalmucks at this moment, it is not far to go. Any one of you may go and see these Tibetans from the Volga right into middle China, where you have one continuous devotion to the faith embodied in this extremely corrupt form of Buddhism. Now, it is because we have still an enormous amount of ignorance in regard to the history of this region and of these people that one feels so grateful for this expedition, and that I have been so anxious, on behalf of the historians and the ethnographers and the archæologists, to add my humble testimony to that which has already been given by my two friends who have spoken.

The CHAIRMAN: There remains but very little to say on the wholly admirable paper you have heard read by Sir Frank Younghusband. There have been many points touched upon which would no doubt interest us exceedingly to discuss a little further. But as the time is late, I will merely refer to the fact that the geographical results of this mission may be described very shortly. We have succeeded at last in gaining a sound scientific basis for all those surveys which have preceded. You may know that for many years (since the days of Walker and Montgomery) native surveyors have traversed Tibet from end to end, and it is from the work they have accomplished that the maps we have hitherto had of Tibet have been constructed. Now we are able to give them that satisfactory and scientific basis they so long have wanted. We may hope that hereafter the process of exploring Tibet fully will not be stayed. Sir Frank Younghusband has said that he fears one evil may arise from the mission which he has so successfully brought to a conclusion, which is that the work of exploration will be greatly restricted in future. I don't think we need call that an evil. There is still plenty to be done, and I think we may safely say that those guardians of our frontier who think it so wrong to look over our neighbours' hedge will take care that we do not work too freely nor too fast. I will ask you now to join in a vote of thanks to Sir Frank Younghusband for his admirable paper, and to thank him, not only for coming here to-night in order to tell us of his mission, but for this added grace, that he has promised that if any large numbers of this society have been unable to find standing room to-night, he will repeat his lecture to an overflow meeting. This for a busy man like Sir Frank Younghusband is

indeed a great promise. I will now ask you to give your thanks to Colonel Younghusband for his paper.

Sir FRANK YOUNGHUSBAND, in response, said: I wish to thank you all for your very kind attention to-night, and for the very deep interest you have shown on behalf of myself and on behalf of all who accompanied me to uphold the great traditions of our race.

Owing to the fact that many Fellows were not able to obtain admission to the meeting on February 13, Sir Frank Younghusband kindly repeated his paper to a crowded audience on March 10.

After the paper, the PRESIDENT said: We have all listened with great attention to this most important and interesting address of Sir Frank Younghusband, and he has enabled us, better than we could do before, to realize the very great service he has done to geography, and the still greater service he has done to the State. We should remember that 120 years ago our first Governor-General had opened the same friendly diplomatic relations with Tibet, had established a trade, and had opened a fair for the Tibetans at Rangpur; but unfortunately his policy was neglected after his leaving India, and nothing was done, except in 1886, when there was just a chance of our sending a mission, which was not sent. All that time, until this great and important work was entrusted to Sir Frank Younghusband, Tibet was entirely neglected. Now, through the able work of this great public servant, we again have opened diplomatic relations, friendly relations, with these people. Only three days ago I received a letter from Lord Curzon, our Gold Medallist, in which he mentioned that he had had a letter from the Teshu Lama, and he looked forward to placing that letter by the side of the two letters which had been sent by the Teshu Lama in a previous incarnation to the envoys of Warren Hastings. Lord Curzon intends to place these letters side by side in his great Victoria Institute at Calcutta. The establishment by Sir Frank Younghusband of agents at Gyantse and Gartok will do what Warren Hastings intended to do, and open, in course of time, most important commercial intercourse between India and Tibet. It is difficult to express to you how strongly I feel towards Sir Frank Younghusband for these great services, and also for his extreme good nature in undertaking to read his paper to us a second time. You will join with me, I am sure, in passing a most cordial vote of thanks to Sir Frank Younghusband.

Sir FRANK YOUNGHUSBAND: I thank you for the very kind attention with which you have listened to my lecture this evening, and I wish to express my special gratitude to Sir Clements Markham for having come here to-night when I know with what difficulty he has had to come. He probably has a better knowledge of Tibet, from his study of it, than I suppose any Englishman up to the present time. I therefore feel especially gratified at the very complimentary remarks he has been pleased to make.

EXPLORATION IN BOLIVIA.*

By Dr. H. HOEK.

TOWARDS the beginning of September, 1903, we found ourselves, after a long and dusty journey, at Jujuy, the last station on the North Argentine railway, situated at the foot of the Cordilleras. Our little party, consisting of the leader, Dr. Steinmann, of Freiburg, Baron von Bistram,

* Read (by Mr. W. Rickmer Rickmers) at the Royal Geographical Society, December 12, 1904. Map, p. 588.

and myself, had now the pleasant task of searching for mules and servants, one in which we received valuable aid from Dr. Moreno, the well-known Director of the La Plata Museum. We resolved to give both man and beast a trial before concluding our bargains, and for this purpose chose the virgin forest of the Cordillera de Sapla and the Rio Garrapatal basin north-east of Jujuy, through which we rode to San Pedro. This typical example of a liane forest was absolutely untrodden, and in many places we had to hack our way through with the knife. We found much to interest us in the Cretaceous formation of the Garrapatal which contains bitumen and fish fossils. The hilly nature of the region tried our mules somewhat, and they were further tortured by the picos (sand-fleas), while we ourselves were the prey of the garrapatas or ticks. At San Pedro we reached the track of the new railway Perico-Ledesma, which at that time was working as far as San Pedro.

Our ariero (the name of an overseer of a troop of mules) appeared in a good light. A native of East Bolivia and of almost pure Indian breed, he nevertheless spoke Spanish well, could read and write, and was, moreover, quite trustworthy—a striking example, in fact, of the capacity for civilization possessed by the Quechoa Indians. The mules proving satisfactory, we bought sixteen of them, it being very expensive, and indeed almost impossible, to hire such for long journeys. Moreover, with an ariero and one's own mules one is practically independent. The export trade to South Africa has caused a considerable rise in the price of these animals. Whereas formerly one could be got for from 20 to 30 dollars, we had to give as much as 200 dollars apiece (£18) for our riding-mules. As Signor Moreno kindly proposed to accompany us as far as Rinoonada, in the gold of which he was interested, we made a *détour* to the west instead of going straight to Yavi, the Bolivian frontier station which had been our original destination. The much-frequented road which until quite recently led from Potosí to Jujuy by way of Tupiza has been reduced to a desert by the construction of the Antofagasta-Oruro railway, so that now no facilities exist for sending things to Potosí.

On September 23 we left Jujuy, passing the night at the isolated posada "Volcan." Here, stretching for about 2½ miles into the valley, is an enormous cone of *débris* broken off from the Cerro Cordoba (15,500 feet), on the west. This mountain I climbed the following day, being anxious to determine its height, as well as to catch a glimpse of the mountains to the west (Chañi group). As it is possible to ride a considerable distance up the mountain from "El Volcan" (6200 feet), the tour can be done in a single day.

For four days we rode on through the stone-filled valley past Tilcara, Humahuaca, and the isolated house of Negra Muerta. Now and again the continuity of Palæozoic quartzite and slate was broken by Cretaceous sandstone (Petrolifera), the fantastic forms and variegated colour of

which were very striking. Crossing the desert-like Pampa Azul, where two lacustrine terraces are to be seen, we reached Cochinoca by way of a small pass. Here we had difficulty in replenishing our larder, the Indians obstinately refusing to sell either a living sheep or dead mutton. A long ride over a plain of deposits grown with grass and tola bushes brought us to Rinconada. The "tola" (*Lepidophyllum*, sp.) covers an immense area; in its appearance, as well as in the manner and extent of its growth, it resembles our heather. Halfway between Cochinoca and Rinconada, near the Angosta Queta, Steinmann found typical fossils of the lower Silurian age (Didymograptus). At Rinconada, which is famous for its gold-bearing quartz

QUEBRADER HONDA.

veins embedded in Palæozoic slate, we spent a day and a half, which Steinmann and I employed in climbing to the summit of the gently undulating mountain chain in the west, the Cerro Salle Grande de San José (16,690 feet), whence we took excellent bearings of the high volcanic groups in the north and north-west. While we were there a herd of vicunas passed quite close to us. On the salt swamps of Pozuelos, the remains of the lake which once covered the pampa of Rinconada, we had to remain a day, our mules having decamped.

Bidding farewell to Signor Moreno, we crossed the Cordillera de Escaya by a high pass (13,520 feet), finding in this chain granitic laccolithe in connection with Silurian slate.

On October 4 we reached Yavi, which lies at the foot of characteristically roof-shaped mountains of cretaceous rock richly studded

with fossils. The river which flows past Yavi falls into the Rio San Juan to the north, and from the heights to the west of the town we had a magnificent view of its barren, winding, cañon-like bed.

On October 7 we proceeded over the Pampa towards the north at a sharp angle to the long Victoria chain of mountains. This mighty range is the boundary-wall between the mountains of the west and the declining high land to the east. Further north, in the neighbourhood of the Rio Grande de Cotagaita, it splits into numerous groups. The fossils found at Salitre, where we touched these hills, point undoubtedly to the Cambrian origin of the latter (*Agnostus*, sp.). Here the Victoria chain forms a kind of bay entirely filled with masses of recent *débris*.

VALLEY OF THE RIO LA PAZ, LOOKING EAST.

Further north the convergence of these chains forms the great plain of the Pampa de Tacsará. This is drained by the Quebrada Honda, which runs in a deep gorge in the south of the plain, and passes through the western chain.

Crossing the Abra Tincuya of the western range we reached the region of Tacsará, and caught a view to the east of what are probably the culminating points of the Victoria chain, the Cerro Campanario and its neighbours. To ascend the former and fix its height, and that of the neighbouring peaks, was our ambition, which we fulfilled on October 10, after a somewhat troublesome climb over ... To our disappointment, we had only a view to the we...

feet below us a sea of cloud blotted out the landscape; but the fact that no peaks were visible above this pall of mist allowed the inference that the Victoria chain falls abruptly to the east. The Cerro Campanario is 16,665 feet, and shows no clear trace of glacial action.

Proceeding over the Abra de Chorcoya (13,550 feet) northwards into the basin of the Rio Escayache, we crossed the Victoria range by the Abra de Sama (12,920 feet) to Tarija (6250 feet). A well-made but exceedingly steep road leads from the mountains to the tropical region of Tarija, a town formerly celebrated for its monastery which still contains the largest library in the country. Of the diluvian strata of this region and their celebrated fossils I need not speak.

The whole of this huge region descending to the east consists of a series of shallow folds or parallel chains cleft by the Tarija river on its eastward course. These chains are of different formation. Our descent from Abra de Same, for instance, took us over Silurian, an excellent place for finding Dictyonema being Cuesta de Erquis. The formation of the following chain is Devonian, that of the third Cretaceous, the deposits in every case lying concordantly. We spent six days in Tarija, where Steinmann succeeded in fixing the longitude by means of time signals from the Cordoba Observatory. On October 20 we left this beautiful and fertile landscape and crossed the cordillera a second time, on this occasion by the Cuesta de Escayache (12,000 feet) somewhat further to the north. After a two days' journey through deeply eroded mountainous country we reached the Rio San Juan, the northern course of which we followed until it abruptly turned eastward. Its isoclinal valley, consisting of Cretaceous sandstone, is continued to the north, and through it we passed over an unimportant pass into the valley of the Rio Grande de Cotagaïta. This river, which flows for a time from north to south in the same long isoclinal valley, also breaks through the eastern side of the latter to join the Rio San Juan on its way to the Rio Camblaya. This part of the valley of the Rio Grande, also called the Valle de Cinti from the town of that name, is a spot of Eden-like beauty, that is so far as the water can be used to fertilize it, the dark red of the soil and of the sandstone walls forming a beautiful background for the green of the foliage. Vineyards are the chief product of the soil, but, owing to the difficulty of transport, nearly all the grapes are made into brandy.

From Camargo (Cinti) we proceeded north, and then north-west by way of Tacaquira, Sivingomayo, and Otavi to Potosí. Here the great synclinal of sandstone in which we had ridden so long seems to come to an end. It is quite clear that a general surface of sandstone must originally have existed here, the remains of which are preserved only in great synclinals, ditches, and troughs. Between Sivingomayo and Otavi we crossed a second small trough of Cretaceous sandstone. For the first two days our course led through a mountainous country with

deep ravines void of protruding formation; indeed, it had rather the character of an eroded tableland.

Near Chichamayo we caught our first sight of the Cordillera de Liqui, and at Sivingomayo we reached a good starting-point for the ascent of the Cerro Liqui, the highest summit of the range, the height of which I fixed at 16,900 feet. From this point I gained a very clear idea of the orographical conditions of the surrounding country. The Cerro Liqui bears traces of former glaciers, unfortunately not very distinct, as it consists of slate which is not at all conducive to the preservation of glacial phenomena.

FLEXURE IN CRETACEOUS SANDSTONE, NEAR THE NEGRO MUERTA.

The following day brought us through the previously mentioned sandstone region of Otavi, the most prominent mountain of which is the Cerro Nnuqui. For a whole day we rode westward over the great Pampa of Lava to the foot of a mighty mountain range, the Cordillera de Andacaba, which, with its northern continuation of the Cari-Cari chain, we will call the Cordillera de Potosí. The map recently published by Germann represents it as covered with eternal snow, which is, however, by no means the case. Mighty moraines, up to 700 feet in height, surround the peaks of this cordillera, and this, the first unmistakable sign of former glacial action, induced us to avoid the direct route to Potosí and turn to the mountains in the north, where Señor Arzes' mine, Andacaba, gives the height of 15,378 feet, an excellent point

from which to start. We ascended the peaks Hembra de Andacaba (16,590 feet) and Anaroyo (17,100 feet), the beautiful weather allowing us an insight into the topography of these mountains, the mightiest chain we had met with since Jujuy, and one much neglected in all maps.

Riding westward on execrable paths and for a long way over enormous moraines, we reached Potosí on November 3. Of Potosí with its Cerro and its silver, I will not speak, as others worthier than I have already described it. I prefer directing your attention to a spot west of the town, where the mountain chain is cleft into a narrow ravine by a small stream coming from Potosí, and where a magnificent example of discordance, induced by folding, is to be seen. Or I would dwell on the charms of Miraflores, the beautiful watering-place whose roses and fruit trees afford such an agreeable contrast to the desert of Potosí. Hot springs and many Cretaceous fossils make this spot of peculiar interest to the geologist.

Leaving Potosí on November 11, we turned eastward, crossing the Cari-Cari chain by the Illimani pass (16,270 feet). A long descent over one of the most magnificent glacial regions imaginable brought us to San Bartolo, whence the direct route to Sucre turns to the north. Riding for the most part in an easterly direction, we crossed a narrow and somewhat deeply ridged trough of sandstone, reaching at length the northern continuation of the Pampa of Lava-Otavi, here much intersected by the northerly directed waters of the upper Pilcomayo. On the Rio Mataca (which flows north to join the Pilcomayo), at the foot of the mountainous region which forms the northern continuation of the Liqui-Nuqui group, we were for a night the guests of some friendly inhabitants, which made a pleasant interlude in our journey. Continuing eastward, we wound during two days up the heights between the separate waters of the Pilcomayo, taking special pains to understand this complicated and deeply ravined region. After climbing several high passes (Escaleras, 13,750 feet; Lampasar, 13,120 feet), we at length descended, on November 12, about 8200 feet to the Pilcomayo, which has here carved for itself a bed out of dazzling red sandstone. The combination of luxuriant tropical vegetation with the varied colours of the mountains and the remains of former settlements produces a picture full of magic beauty. Continuing north-eastward, we rode up the Rio Uyuni to Icla, where we devoted a day to the beautifully preserved Denovian fossils, amongst which the incomparable canularias are specially worthy of notice. The geography dealing with the origin and sources of the upper waters of the Pilcomayo is not of much value, and most of the maps of that part are drawn solely by imagination.

From Icla we proceeded to Sucre, passing the large Indian town Tarabuco (30 miles from Icla) and the smaller market town of Yamparaiz, between which the road traverses for a whole day the

watershed between the Amazon and the La Plata. Sucre, a town now practically dead, retains nevertheless some traces of its former splendour as the seat of government. Its vehicular communication with Cochabamba has ceased, while the post road is partly in ruins and useless for carriages at the present day. For three days we followed this route as far as Finca Constancia. The country here is a paradise of beauty and may best be described as a tropical park landscape. In the valleys there reigns eternal spring. All the cultivated plants of the temperate zone thrive, in addition to such tropical kinds as sugar-canes, bananas, and chirimoya, while swarms of green cockatoos fill the air with their screams. The Finca Carapari, in particular, in the valley of the Rio

LANDSCAPE NEAR TARIJA.

Grande, would be a paradise but for fever. Our enjoyment of these beauties was short-lived, for with Aiquile and Mizque we entered a higher and more barren region. The latter, formerly a most flourishing place, has been almost devastated by fever.

To our chagrin we had to spend a day at the latter place because of the rain which had set in exceptionally early that season.

Mizque is separated from the fertile plains of Cliza and Cochabamba by the Khuri chain of mountains running east-south-east. An attempt to cut a good mule-path here had been abandoned, and our ascent of the Quevincha pass (12,350 feet) was made on a wretched and very slippery path at the end of which we had to camp in the rain. Continuing next day along the crest west-north-west, we found traces of former extensive

glaciers. A steep descent brought us to Arani, in the plain of Cliza, whose waters flow towards Cochabamba, reaching the Rio Grande by a very circuitous route.

On December 2 we reached Cochabamba (plain of wells). This town, situated at a height of 8530 feet at the foot of the imposing Cordillera of Tunari, was the centre from which we made our expeditions the following month.

Our next natural goal was the mighty mountain wall to the north of Cochabamba, whose summit is the double peak of Cerro Tunari. This mountain, as well as the whole range, was, on every occasion we saw it, covered with snow, but reports in Cochabamba, always contradictory, however, deny that it is eternal.

A first attempt to penetrate the range was unsuccessful. We had endeavoured to carry a tent and provisions from Iscaïpata, about 20 miles north-west of Cochabamba, to as high a point as possible, but the loss of two mules, which fell with the baggage down a steep slope on the way up, frustrated the design. Little of the lost property was recovered, and a further obstacle was made by the weather, which had become more than dreadful.

On December 14 we made another start, choosing for our ascent this time the wider valley of Llave, further to the west. At a height of 12,470 feet this valley forks, the western branch leading through a pass of 13,100 feet to Murachata, the eastern through one of 13,788 feet to Cocapata. At the point where it divides we camped.

The next day, after climbing through a steep snow gully, Prof. Steinmann and I reached the smoother north side of the Cerro Tunari, and afterwards the ridge between the two peaks. From this point I climbed the twin summits (17,060 feet). Their height was fixed by means of a boiling-point thermometer, and was corroborated by the continuous barometrical readings in Cochabamba.

The view to the north surprised us. The maps we had studied had led us to expect a gradual descent of the land on that side, instead of which there arose range upon range of mountains, some of which were at least 1650 feet higher than the Cerro Tunari itself. During our whole tour in the region of the Tunari we met with nothing but Palæozoic rocks. Glacial phenomena engaged our particular attention. As in the Alps, so here there are three great phases to be distinguished, a fact which later experience has since everywhere confirmed in South America, wherever we went. From the moraines of the first phase there stretch enormous deposits of fluvio-glacial origin, and these form the whole base of the Tunari range towards the south, cleft by the deep cañon-like gorges of the rivers issuing from the mountain valleys.

The week before Christmas Von Bistram and I rode through the pass Puca Puca (13,120 feet) to Colomi, and through the Abra de

Málaga (12,550 feet) into the region of the "Yungas," working our way over roads fathom-deep in mud, through forests and tropical rains as far as the Rio Espiritu Santo (3240 feet). This road had gained a temporary importance by the action of Brazil in closing the Amazon route to the export of Bolivian gum, owing to the Acre dispute. Throughout our journey from Cochabamba through Sacaba to Colomi and Incacorral, we met with nothing but Palæozoic deposits, Silurian and Devonian slates and quartzite. Beyond Incacorral the forest vegetation makes all geological observation impossible. It was particularly striking to note how far down on the eastern slopes of these mountains the traces of the glacial epoch extend, polished and scarred

CAÑON OF UPPER RIO PILCOMAYO—SANDSTONE WALLS.

rock-faces everywhere witnessing to the action of ice. It is evident, too, that the mountains on this side were more exposed to moisture during the Ice age than the so-called "puna."

In the mean time Steinmann had made an excursion westward to Capinote, a locality abundantly rich in magnificent Carboniferous fossils.

On December 29 we left Cochabamba for Oruro by the ordinary much-used and well-known mule track which leads through the passes of Tapacarí (13,920 feet), Confital (13,850 feet), and Incaracay (13,900 feet), past the localities of Parsotaní and Tapacarí. In addition to this path there is a carriage-road from Cochabamba to Oruro, open for regular traffic during the dry season, which leads through the village

of Capinote. I mention these well-known routes because they have been wrongly indicated on the recently published map by Germann. We stayed but a short time in Oruro, starting almost immediately for our expedition through the mountains of Santa Vera Cruz and Quimsa Cruz to Araca and La Paz. I may mention that in the immediate neighbourhood of Oruro beautiful specimens of old lacustrine terraces and tuff deposits are to be seen (cf. Minchin). We believe that there is some corresponding connection between these indications of voluminous lakes and the three glacial phases, seeing that both phenomena must be traced back to a wet and cold climate.

There exists great uncertainty as to the geography and nomenclature of the mountainous region stretching eastwards from the pampa between the valley of the Rio La Paz and the eastward bend of the Cordillera Real. This range is separated from the pampa almost through its entire length by the deep valley of Luribay, which here runs from south to north. Though a region rich in minerals and frequented, especially of late, by "mineros" (prospectors), exact details about it are nowhere to be found. Most travellers speak of a mountain "Quimsacruz," but, as a matter of fact, there is a range of mountains about 64 miles in length divided into three chief groups with numberless peaks.

During our tour in this region we localized the following mountains, all of which have been correctly indicated on Germann's map. The "Nevados of Araca," the direct continuation of the Illimani, a wild, mountainous region with beautiful peaks and numerous glaciers, nearly all of which look to the south; joining this on the south are the "Nevados de Quimsacruz" (more correctly Quimpsa, "Three"). The relatively deep gorge of the Abra de Tres Cruzez (15,160 feet) separates this group from the southern corner pillar of the whole range, the shining summit of Santa Veracruz (wrongly Velacruz). The eastern drainage of these three chains has so far been wrongly indicated on every map. On the west the Araca range drains into the Rio Araca, which itself joins the Rio La Paz before the latter breaks through the range. Ultimately the Rio La Paz receives also the western drainage of the Quimsacruz and the Santa Veracruz, which empty their waters into its tributary, the Luribay.

From Oruro we proceeded to Caracollo, and, turning east, passed the Cordillera at its eastward bend, where it becomes lower. After a four days' journey through the villages Colquiri and Ichoca, on the eastern side of the Veracruz range, we found ourselves at Quime. From here a relatively good road led over the Abra de Tres Cruzes (15,160 feet) to Yaco, whence we turned northward between the Quimsacruz range and the valley of the Rio Luribay, crossing several passes. After that, turning somewhat east, we passed the watershed of the Abra de Cairoma (13,225 feet), and reached the upper valley of the Araca.

On the eastern side of these mountains (Inquisive, Ichoca, Quime) vegetation and landscape have the character of the "Yungas," while the western side is puna-like in appearance, arid and sterile. The mountains themselves are high alpine and of a charming beauty. Their structure seems similar to that of the Illimani, a granite nucleus surrounded by Palæozoic deposits, whereon lie concordantly Cretaceous sandstones. As regards the height of the summits, I can only speak with certainty of those of the Araca range. Near the mine Viloco (13,290 feet), I climbed a rocky point from which was visible an overwhelming view of Illimani's rock wall rising sheer out of the depths of the La Paz valley. I fixed the height of my peak at 17,720

CRETACEOUS MOUNTAINS OF YAVI.

feet, and estimate the neighbouring snow-clad summits at close on 16,690 feet.

On January 4 we descended into the valley of the Rio La Paz, whence we climbed the Finca Cotaña; but I shall not venture to describe either it or the road to Cohoni and La Paz, as I cannot hope to equal Sir Martin Conway's beautiful description of this Bolivian high-level road. Moreover, our later experiences, our journey to Peru, our ride through the desert from Tacna to Coro-Coro, and my ascent of Cerro Tacora (19,900 feet) form another story.

I append a *résumé* of the scientific results of our (Dr. Steinmann's) expedition.

The map has been improved in the topography of the following districts. The northern end of the Cordillera de Victoria; the Pampa de Tacsara between Yavi and Tarija; the Cordillera de Liqui; the mountains in the east of Potosí, called the Cordillera de Potosí, and divided into the groups of Andacaba and Cari-Cari; the head of the Pilcomayo between Mataca and Iola; the range of the Cerro Tunari north-west of Cochabamba; the ranges of Santa Veracruz, Quimzacruz, and Araca, which form the continuation to the south of the Illimani group.

The height of about two hundred and thirty points has been determined by means of five aneroid barometers, which were regularly checked by boiling-point thermometers. The latitude of a great number of places in southern Bolivia was fixed, as also the longitude of Tarija and Potosí, the latter by telegraphic time-signals from the observatory of Cordoba.

As to the geology, I must confine myself to a very rough sketch of the general results.

The sediments found in South and East Bolivia are Cambrium, Lower Silurian, some traces of Devonian and carbon, and as the most recent marine deposit the deep layers of red Cretaceous sandstone, which under ordinary circumstances is only preserved in troughs and folds.

This entire system of sediments lies concordantly, with the exception of some places where differential movements caused by the folding process have disturbed the original concordance. The tectonic occurrences are very plain and simple. On the whole, we observe a folding structure on broad lines and of great dimensions. Nowhere do we meet with the complicated conditions reigning in the Alps. We were specially interested in the witnesses of former glaciation, and we have been able to establish three phases which correspond exactly to those of the Alps and North Europe. The necessary proofs were furnished by moraines in a state of more than excellent preservation. The more one approaches the equator the higher the snow-line, the greater, also, the elevation of ancient glaciation. We found it at 9515 feet in the Tunari, the Quimzacruz, and the Araca mountains. It is worthy of notice that the eastern sides of the mountains have always been exposed to greater moisture, and that therefore they show the remains of former glaciation at a lower level than on the western slopes. On the other hand, we observe that even the most southerly of the isolated volcanoes have borne ice-caps; thus the Cerro Tacora, which has a belt of enormous moraines as far down as 13,780 feet.

The lower level of the glaciation descends as we proceed further south, and thus keeps more or less parallel to the snow-line of to-day. Near Cochabamba it lies between 9190 and 9515 feet.

A former glaciation of Brazil is, of course, out of the question. Such

speculations as have appeared on the subject were due to a misinterpretation of certain phenomena.

Before the paper, the CHAIRMAN (Colonel G. E. CHURCH) said: Our paper this evening is on a very interesting section of South America, through the northern part of the Argentine Republic, and skirting the foot of the hills of the Andes and various points in Bolivia. I will now call on Dr. Hoek to read his paper.

After the paper, the CHAIRMAN said: We have the pleasure of having with us this evening Colonel Suarez, *charge d'affaires* of Bolivia. Perhaps he will favour us with a few remarks.

Colonel SUAREZ: I have listened with great pleasure to the very interesting lecture about Dr. Hoek's travels in Bolivia. I am very pleased indeed that some interest is being taken now in South America. It is not very long ago that I was invited to a country house in England, and when I arrived there I only found the ladies of the house-party. They were all staring at me, and I could not make out what was the reason. But soon I discovered it. One of the ladies of the house-party brought me her album, and asked me to write my name down and the country from which I came. I did so, and after having written "Bolivia," she asked, "Something else?" I said, "What?" "Something else?" I said, "South America?" "Yes," she said, "that is what we want." And then the lady of the house told me they had been discussing at length where Bolivia was; some said it was in South Africa, and some in Bohemia. When she told me this, I found out they expected to see me dressed in feathers. That is why I am so very thankful to Dr. Hoek, Colonel Church, and Sir Martin Conway, who have travelled there and given you some idea of Bolivia. You will see we are not quite in the state in which things were originally found. I hope at no distant date the country will be opened up with railways, and I dare say Messrs. Thomas Cook & Son will be selling you tickets and taking you over to make a few excursions up the mountains. I may tell you we have all sorts of climates there; you can choose your own. We have not such a pretty climate as you have in England, where in a few hours you have five or six changes; but, all the same, I think we could offer you some very nice climates indeed. I heard Dr. Hoek's remark that the principal industry is mining. It is so; but I may tell you that we also have indiarubber. The indiarubber that comes from Bolivia they call Para rubber, because it passes through the port of Para; the best comes from Bolivia, and is then shipped to Europe. We also have great opening for agriculture, as to which Colonel Church will be able to inform you, for he was in Bolivia some years ago, and he took great interest in that country, and I hope he will still do so. In conclusion, I have only to thank Dr. Hoek for his lecture on Bolivia.

The CHAIRMAN: I also see our well-known friend, Señor Aramayo, late Minister of Bolivia.

Señor ARAMAYO: I thank you for calling upon me to say a few words on this occasion, but I have nothing to add to the feelings already expressed by Colonel Suarez on behalf of Bolivia. I have only to say that I thank Dr. Hoek for his very interesting lecture to-night, which has instructed me on many points respecting the geology and geography of my own country; and I am sure it is very satisfactory to see that the exploration conducted by my old friend Dr. Steinmann has been so successful in Bolivia, and has given an opportunity to this Society to hear a good deal of the interesting resources of the country.

The CHAIRMAN: With your permission, I will occupy a few minutes of your time. I have read Dr. Hoek's paper carefully, and he is to be complimented on the information of varied character it contains. Once we get the accurate

map of his travels, it will be a great advantage to the geography of the region of which he has treated. But his paper once more opens the old question of the glaciation of South America—an ice age, of which he says there were in the Andes three marked epochs. We know that, so far as North America is concerned, the ice-cap extended south to about 35° N. lat. This paper brings forward prominently an ice age on the southern half of the continent, where glaciation extended north at least as far as 17° S. lat., at a point in the valley of the Amazon at about 5000 feet above sea-level, north of Cochabamba. Here Dr. Hoek found numerous evidences of glacial action. The theory of Agassiz as to the glaciation of the Amazon valley and of all Brazil has been, to the satisfaction of most people, completely demolished by the studies of the geological section of the Brazilian Government, and especially by the eminent geologist, Dr. John Branner. He has gone very thoroughly into this ice question, and finds that the crystalline rocks of Brazil, from Rio de Janeiro to the Amazon, are subject to a softening process. In the case of gneiss, granite, and diorite, the decomposition sometimes reaches a depth of more than 300 feet, and hard felspathic-porphyry is decomposed from 12 to 15 feet deep. Some of the Miocene rocks are decomposed to a depth of 370 feet, and in the carbonaceous formation as deep as 400 feet. This process splits off immense masses from the slopes of the mountains, and these are broken into fragments, large and small, which exfoliate on their edges and form boulders, that are piled up in such profusion that well may they be taken for moraines. This was true of a mass of dioritic boulders that Agassiz found 400 or 500 miles up the Amazon, on the north side, and which he took as morainic formation, but which was afterwards discovered to be composed of boulders of decomposition. Similar deposits may be found all along the coast of Brazil inland, and have all been proven to be of the same nature. Such softening of the rocks in the South American tropics goes on at a much greater pace than it does in the temperate zone. For instance, the amount of nitric acid and carbonic acid in the atmosphere, and especially the former, is very great, and is said to be formed from the electric discharges of the atmosphere, and this helps the decomposition process. Again, something which seems to have deceived a great many geologists, and made them think they were looking upon traces of glacial action, is the "fluting," examples of which are numerous in the Brazilian rocks. A drop of water trickles down, and ultimately a little stream forms a groove, until finally in the course of ages it grows deeper and deeper—anywhere from 6 inches to many feet. If my statements be correct, one has to accept the glacial theory with reference to Brazil and any part of the Amazon valley with reserve; but I have no doubt that the eminent gentlemen who have made these geological examinations now under discussion thoroughly understand that their views are in conflict with the geologists who have so exhaustively studied the problem of South American glaciation in Brazil. Dr. Hoek has been examining the slopes of the Andes—what shall I say? from 22° S. lat. up to 17°, where he found glacial action at a very low elevation, at the Amazon base of the Tunari range. This point is 360 geographical miles nearer the equator than Rio de Janeiro, in the vicinity of which the mountains rise to the elevation of 10,040 feet, mountains of such friable material that, had they ever been glaciated, they would have melted like sugar. It seems doubtful if any isothermal lines could ever have compensated for this difference of latitude and great elevation. But the glaciation of Brazil having been disproved, query, do we not require still further knowledge regarding these supposed glacial evidences reported from Bolivia before we can thoroughly accept the views set forth in Dr. Hoek's paper? May not his moraines also be boulders of decomposition? I do not assert that they are; but the question is interesting, and so able and devoted a scientist as Dr. Hoek will, I feel certain,

make it more so in the future. I have simply thrown out a few ideas; but I may say to Dr. Hoek I am not a professional geologist, only an amateur; but the two sides of the continent seem to be so in contradiction that we hope we shall have more information from Dr. Hoek himself. I was going to ask him to give it to us now, but, as he seems to be a little shy of his good English, we must hope that he will favour us in some other form later on. In any event, I think I express your sentiments in thanking Dr. Hoek most heartily for his paper, and also the very excellent mouthpiece he has brought with him, who, I may say, has adorned science with the eloquence of poetry.

A TRIP INTO THE CHILI PROVINCE, NORTH CHINA.*

By the Rev. JOHN HEDLEY.

It had long been my desire to take a trip through the Great Wall of China, and see for myself at least a part of that large tract of country known as the Chili Province. My travelling companion was Mr. R. J. Gould, sub-agent of the British and Foreign Bible Society in Tientsin, and the primary object of our journey was the dissemination of Scriptures. We started off from this ancient city of Yung-Phing fu (Eternal Peace), whose history can be traced back for 3000 years, on October 19, 1904.

Not only did we travel without escort, but without firearms of any description whatever, and when it is remembered that the district is proverbial for lawlessness, it says something for the local government that we were not once placed in any position where firearms would have been of value. The friendliness of the people was most marked.

On October 22 we passed through the wall at Lŭng-ko (Cold pass). Lŭng-ko is the only pass for some miles round possible for vehicular traffic. Several other passes, as Liu-chia-ko and Tao-lin-ko, are in the vicinity, but boulders lie so thick that it is impossible for carts or barrows to get through. Animals and foot-passengers, however, use these passes regularly, and so reach their destinations quicker than would be possible were they confined to only one exit. At all these places custom houses are found, and taxes levied on goods passing to and fro. Books alone are exempt from duty, so we got through without any delay on that score. The pass at Lŭng-ko, through which the Sha Ho (Sand river) flows, no longer boasts the tower that once spanned the river, its place being taken by a sort of barrier made of inverted poles across the stream. The tower was destroyed by floods in the year 1850, and of course there has never been any attempt made to replace it. A very fine specimen of the ancient towers still stands at Liu-chia-ko, some 10 miles east of Lŭng-ko, of which a print was recently sent to the R.G.S.

* Map, p. 588.

Through the pass the road runs alongside the stream and under the shadow of the towering hills on which the Great Wall is built. The character of the scenery changes immediately, for whereas inside the pass the hills are for the most part barren, we were surprised to find the north side thickly studded with trees, not only making the landscape much more beautiful, but affording to the people a plentiful supply of fuel for the cold winter months. This continued until we had got some distance beyond Chaw-chang-ko, a distance of about 50 English miles, and, in response to our inquiries, we were everywhere told that within that radius fuel was the cheapest of the daily necessities. In the former part of this distance, firs and willows are most common; later, in addition to these, we came upon very fine poplars, while when we reached Chaw-chang-ko we found all the hills clad with a species of small oak tree, the branches and leaves of which make most excellent fuel. Indeed, the range of hills there takes its name from these trees, Paw-law Shan (Oak-tree hills), though, strange to say, the natives denied all knowledge of that name as applied to the hills. We also found that near the wall brown rice was grown, this being due to the presence of the Sha Ho, and men were even then busily engaged in banking up the river and diverting its course into their paddy-plots (they are too small to be called fields). That they appreciate home produce is evident from the answer we received as to its quality, "better than the white rice which comes from the south." The whole of this district suffered severely at the hands of the Hung-Hu-Tzus, often spelled Chung-Chu-Tzus (Red-beards) two years ago, the people everywhere fleeing to the mountains for refuge, leaving behind only a few elders to negotiate the ransom.

The road, lying in a fertile valley that varied in width from 400 to 1000 yards, was very good going till we reached the Manchu village of Tu-shih-munn (Earth-stone door). Here we came upon the first of the many "ling" (mountain range) we were henceforward to pass through. Two narrow defiles, not more than 8 feet wide, led us from Tu-shih-munn to Ta-shih-munn (Big stone door), and introduced us to a landscape still more beautiful than any we had hitherto seen. After this we were never very far away from high ranges and narrow passes, but the scenery was so varied and so full of interest that we almost forgot the weariness of body to which we had to submit. The approach to Chaw-chang-ko was one of the most fatiguing of all, and while we thought we had reached Chaw-chang-ko, we found we had only got to Chaw-chang-ko-munn, *i.e.* "the door of the valley." The inn we looked for was 2 miles further on. The light failed us before we reached the inn. Gold is found in the stream that flows through the valley here, but only in small quantities. The natives of this valley seemed a poorer and more wretched set of people than any we met on our journey. We started at 7 o'clock next morning, and at once found ourselves

climbing what seemed to me a sort of spiral staircase. Round and round we went, climbing higher each step. At one point we with our ponies were immediately over the heads of the carts travelling more slowly behind. The descent on the other side, though not of the circular type, was almost equally difficult. The "ling" is exactly a mile long, and some idea of the height of the hills may be gathered from the fact that, although the sun had risen before we left the inn, we had travelled just an hour before it touched us, and then only through a gap in the range. But what we had there was as nothing to what we met at Pa-hwaw-chih-ling, some 5 miles further on. We

SHA HO FLOWING THROUGH PASS AT LENG KOU.

quietly ascended the narrow path, but found it did not get easier as we mounted. The "ling" is more "spiral" and more difficult by far than that of our morning experience, and though we, unfortunately, had no instruments with us by which we could measure the altitude, we had climbed considerably more than 1000 feet—my friend thought at least 2000 feet—when we reached the top. There we were abundantly rewarded for our climb. Issuing out of the narrow defile at the summit, a scene of surpassing grandeur was presented to our view. It even moved the souls of our Chinese companions to speech, so it must have been unusual. Before us, glistening in the bright morning sunshine, were rank upon rank of towering mountains, the sandy face of those in the foreground showing up splendidly

against the dark purple behind. Absolutely nothing but hills and trees were to be seen. Not a hut of any description, not a single person or animal could be discerned. We seemed to have climbed to the roof! The hills here are known as Lama Shan (Lama mountains), and a garrulous guest at the inn where we stayed in the evening assured us that on the summit of the highest peak stood a temple called Wang Hai Miao (Look-at-the-sea temple), from which the sea in the vicinity of Shan Hai Kuan could be easily made out. This meant at least a view of 60 miles, and the tale was somewhat discounted by his later statement that this mountain was at least 40 li (13 miles) high.

Finding, after all our climbing, that we could not reach the town of Tang-tao Ho before late in the afternoon, we pushed on in a northerly direction towards Tao-urr-tung. About 10 miles south of the town we came upon the Ching Lung (Bright Dragon) river, which flows into the Lan river at my own city of Yung-phing fu. We had our share of that river then, for we forded it no fewer than nine times that afternoon, and next morning a branch of it had to be crossed seven times, as it flows from the hills east of the main stream. We passed within 2 miles of a gold-mine, worked by the China Engineering and Mining Co., Ltd., but which in recent years has not yielded much. At Hu-to-shih (Tiger Head rock), so named from a rock which is an almost perfect specimen of a tiger's head, prospecting for gold has been carried on at various times, but so far without success.

At Tao-urr-tung we came for the first time into contact with Mongolians, staying for the night at a Mongol inn. We were destined to see a great deal of these primitive people on our trip, and I may as well say at once that we were both most favourably impressed with them. My travelling companion, whose work in China had up to this year been in the vicinity of the Yang Tse river, was very much surprised, and, I think, not a little disappointed, to find that the men dressed exactly like the Chinese, wearing the queue and the blue gown, though the women differed from the Chinese in having large feet, a distinctive head-dress, and a very long upper garment coming right down to the heels. He had looked for conspicuous differences, forgetting for the moment that the Mongolians are divided into nomadic and settlers, the former living a roving life on the wind-swept plains of the north, while the latter inhabit the district in a part of which we were travelling. As a matter of fact, inner Mongolia was formerly inhabited by Mongolians only. But generations ago, the Manchu rulers, by a system which they euphoniously describe as "chieh ti yang min" ("borrow the land to support the (Chinese) people"), settled Chinese families amongst them; and now, in the pathetic language of an old Mongol woman with whom we talked one day, "the Mongols are less than half of the population." The villages, however, in their names, still retain memories of their former estate, many of them being known

as this "ying-tzu," that "chang-tzu," and so on. When it is remembered that a "ying" is a camp or a barrack, and a "chang" is a tent or an awning, we have in the nomenclature a record of a past that in many respects is obscure. The Mongols we met struck us as being a much quieter and more friendly people than the average Chinese. They were very free in conversation, even the women seeming to be pleased at any opportunity of speaking to us; so different from the Chinese woman, who, when she does not rush away at sight of a stranger, will hang her head in apparent modesty. Amongst themselves they speak in their own language, condescending to Chinese only when compelled. (Our Mongol landlord at Tao-urr-tung told us

SCENE JUST IMMEDIATELY AFTER PASSING THROUGH LENG KOU, SHOWING CARTS.

that much of the language commonly spoken among the nomads was unintelligible even to them, the settlers.) They all speak Chinese with a soft liquid accent that reminds one of Hindustani, and invariably drop their voices with gentle cadence at the end of a sentence. The harsh strident tones in which the average Chinamen will salute you are never heard from the Mongols. There is no intermarrying between the two races. They dwell together, but are still apart. A man purchases his wife, paying over to her father money, pigs, and clothing. Without these three, he must remain a bachelor. Polygamy, of course, is allowed; our young friend almost indignantly asking me, "Why should not a man have more than one wife, if he can afford to buy

more?" To their religion the Mongols are fanatically wedded; their temples are everywhere in most excellent repair, and many of them really beautiful; lamas with shaven head and yellow robe abound wherever you go, until at Chung-tu fu (Jehol), in the vicinity of the temples, there seemed to be more lamas than laymen. But that, unfortunately, does not mean an overplus of righteousness, for some of the lamas are openly immoral, given up to opium and gambling. One of the most lovely temples I have ever seen, though it was not very large, that at Pai-niu-tsun, was in charge of an old lama who had a Chinese woman living in the temple with him; and we were credibly informed that lying and pilfering are regarded as but trifling matters by the majority of the people. Still, we liked them; their gentle manners and obvious friendliness being a great contrast to the obtrusive curiosity and bold impertinence of their Chinese neighbours.

From the pass at Pa-hwaw-chih-ling, which led us through a valley about 7 miles long, right up to Hu-to-shih, where for the fifth time we forded the Ching-lung river, the country was very bare and desolate. Trees were scarce, the hills were brown and barren, and there was but little land capable of cultivation, the road, like the curate's egg, being good in parts only. Here and there on the hillsides were patches of reclaimed land, some of them at such a height and angle that one could only wonder how animals or plough could stand there, much less work. But the Chinese agriculturist is nothing if not persistent and adaptive, and so many spots, that in another land and with another people would be left to stones and stubble, are diligently worked by these patient sons of toil. Sleeping one night at Tao-urr-tung, we next morning retraced our steps for 4 miles, and turned east through a wide valley that takes its name from Faw-ye-tüng, a small market town some miles along. Here we came again on fertile soil, and after the desolation of the previous day, it was delightful to behold long stretches of splendid soil under the plough. Late in the season though it was, the people were very busy in the fields, and in many places we saw one set of men digging up the roots of the kaoliang (tall Barbadoes millet), which they use as fuel, and others following them with the plough, turning over the land in preparation for next year. Here no wheat is grown, but in such a year as this has been they get magnificent crops of kaoliang, short millet, and black beans. That night we stopped at Ko-munn, known also as Hsiao-ta-tze-ko, sleeping in a long room where some score or more of goatskins were drying, prior to being sold to representatives of Tientsin firms. We rose by mistake early next morning, being out of bed by 1.30, and on the road by 2.50. Early as we were (there was a glorious moon, and a sunrise never to be forgotten, so we felt quite virtuous), we were not the first astir, for that day was marked in the Chinese calendar as a lucky day, and the country seemed alive with people marrying and

giving in marriage. Our wanderings that day ended at Ta-chang-tze, a large and busy town, where we came into touch with the troops of General Ma Yu Kun (Ma of the Pearl mountain), which have been stationed all round this district since the opening of the Russo-Japanese war. A small river, too shallow for navigation, flows past the town to join the Ta-ling Ho at Kin-chau Fu, some 100 miles east. And when one thinks of the amount of business that is done in this and other towns in the vicinity, it seems a pity that no attempt is made to utilize a waterway that would so easily connect with the Peking-Niuchwang railway. Tientsin firms have their representatives here, as in all the large towns of inner Mongolia, the purchase of skins being their

POTALA TEMPLE AT JEHOL, FACSIMILE OF POTALA AT LHASA.

principal trade, though Manchester cottons and American oil are everywhere to be seen. Skins are purchased from the people at the markets, one feature of the landscape being the immense flocks of sheep, goats, and oxen that the people keep. The skins, when dried and packed, are carried on mules across the mountains through Lüng-ko to Hsu Ko Chwang, a station below Tongshan, on the Peking line, whence they are sent on to Tientsin. The distance thus covered by the mules is not less than 250 miles, but the cost of transit seems remarkably low. One hundred catties (about 133 lbs.) cost about 1*s.* 6*d.*, and as a mule cannot carry much over two hundred catties, it seems that a better means of transit might easily be found if the river at their very doors were only

dredged sufficiently to admit of flat-bottomed boats going up. The mules bearing their heavy burdens are constantly met on the road, one man often managing as many as ten or a dozen. They travel very slowly, but do their 33 miles a day.

From Ta-cheng-tze we turned westward to the city of Chien-chang hsien, better known by its local name of Ta-tze-ko. The latter name signifies Pagoda valley, so called because of a famous old pagoda of the Tang dynasty (A.D. 618–707) that stands a few miles west of the town. The pagoda is in a state of ruin now, and an eloquent parable of the old and new is afforded by the telegraph wire that runs immediately in front of it. The streets of Ta-tze-ko are broad and well kept, lined on either side with good shops, many of them in size and style quite equal to what may be seen in Peking or Tientsin. It is also a great trade centre, a speciality being, according to the signboards, the importation of Shantung goods. There are over 700 business houses in the city, while the total population is estimated to be well over 100,000. Like all the cities east of the barrier, that is, in the Mongolian part, there is no wall at Ta-tze-ko. It stands in a fertile valley, through which flows the small river already mentioned at Ta-cheng-tze. The two principal streets run right through the town north by south and east by west, and, though there is never that appearance of bustle that the smaller street of Ta-cheng-tze presents, yet all day and every day a great deal of business is done. Ta-tze-ko ought to have a permanent interest, not only for missionaries like the writer, but for all lovers of the adventurous and enterprising. It was in this city that James Gilmour, whose books on Mongolia have the double merit of accuracy and entertainment, lived and laboured for so many years, after he had toiled, and, to human appearance, failed in his work "among the Mongols."

Both at Ta-cheng-tze and Ta-tze-ko coal is commonly used by the people. It is produced at a place named Phing-ku, 33 miles south of the former town, and carried by mules in baskets over the mountains at a price which works out at a little over $4 (*7s. 6d.*) per ton. The coal workings are entirely in the hands of the Chinese, and are said to be little more than surface borings in the sides of the hills. One old man we met in the inn at Ta-cheng-tze assured us that, to his certain knowledge, coal had been produced at Phing-ku for at least fifty years.

At Ta-tze-ko, as at various stations along the main roads, are contingents of General Ma's troops, all seemingly suffering from *ennui*, due to lack of occupation. The exception to this is at Phing-chuan-chau (Peaceful Spring), otherwise known as Pa-ko (eighth valley, counting from Peking), where the general has his headquarters, and the soldiers are kept hard at daily drill, being in consequence a fine, sturdy set of fellows. But none of them showed any anxiety to assist

PASSENGER BOAT ON LAN RIVER.

Japan to turn the Russians out of Manchuria, of which some newspapers have been making so much of late.

Pa-ko is as fine a town as one need wish to see, while Jehol, of which more anon, is about the most beautiful and inviting of North China cities. Pa-ko, true, boasts but one business street, but that one street is 7 *English miles* long. The shops, as you advance into the town, are equal to those in Ta-tze-ko. The street is fully 30 feet wide, and the constant passing to and fro of carts, big and little, pack-mules and camels, mule-litters and donkeys, to say nothing of men, women, and children, is enough to keep the stranger interested for many hours, and assure him that a considerable amount of money changes hands daily. Coal is found in large quantities within comparatively short distances of the town, while gold and silver mines are worked in several places. The Imperial post has not yet extended its system outside the wall, but the telegraph company has had stations in all these cities for some years, and the poles and wire across the mountains give quite a modern touch to the landscape. The management is not quite so precise as it might be. From Pa-ko to Jehol is a trip to be remembered, if only for the Hung-shih-la-liang-li-hsia (Red Rock pass) which has to be negotiated. From start to finish this pass is over 3 miles long, and the descent on the Jehol side is so steep and precipitous that it is necessary to attach ropes to the back of the carts and have a few men hanging on behind. Fortunately for us, the

road had been recently repaired—a most unusual thing in China—else we could scarcely have hoped for so satisfactory an issue to our trip.

Here, also, in several places we observed large grain baskets filled with heavy stones and partly buried in the earth. My friend thought pilgrims to Jehol had been putting in a few "good works" on the way, by taking up the stones out of the paths. The true and prosaic explanation proved to be that they acted as dams for the rushing water from the mountains in the rainy season, and prevented the carrying away of the crops. In many villages we saw what appeared to be large bundles of straw lying in pools and firmly held down by huge boulders placed at regular intervals upon them. This proved to be the local method of treating hemp, which is thus thoroughly soaked for about three weeks, taken out, and dried in the sun before being worked up into ropes.

Turning northward out of the Red Rock valley into the valley watered by the Je Ho (Hot river), 2 miles away, a beautiful view of the city of Chung-tu Fu (Jehol) (Complete Virtue city) bursts upon the traveller's sight. No city wall obscures the prospect, the houses being built on the sloping hills. Trees and temples add to the harmonious setting, and surmounting all is the wall enclosing the imperial palace grounds, 6 miles in extent, built by Chien Lung over two hundred years ago, and where the unworthy Hsien Fung ended his miserable days (the Chinese would rather say, "became a guest on high").

KU LUNG SHAN (CAVERN HILL) ON LAN RIVER.

Here, too, the shops are numerous and good, though the streets are not so wide as at Pa-ko and Ta-tze-ko. Admission to the palace grounds is possible only on production of a permit from the Wai Wu Pu at Peking, and future travellers would do well to provide themselves with such an authority. Though we could not, therefore, see through the palace, the Tartar general courteously provided us with a guide to the temples, for which the city is famed. These temples, five in number, lie 4 miles north of the city, and the view they present, especially when, as we first saw them, a brilliant sun is glistening upon them, is something to dream about. The valley is well wooded, to begin with; all round are the everlasting hills, so that nature's environments lend

LUNG WANG MIAO (DRAGON KING TEMPLE) ON LAN RIVER NEAR LANCHOU, SAID TO HAVE BEEN BUILT TO PLEASE AN ANCIENT EMPEROR. THE ROAD GOES THROUGH A TUNNEL BENEATH THE MAIN HALL.

their beauty to the works of man. Two of the temples are roofed with brass tiles, which are said to have had a coating of gold, while magnificent fir trees, the Chinaman's pet, fill all the courtyards. Naturally, to us the Potala temple was most interesting, not on account of its beauty, but in view of recent events in Tibet. This temple at Jehol is said to be a miniature copy of the Potala at Lhasa, of which we have of late heard so much. There are a great number of lamas in residence here, some say seven to eight hundred, but on the day of our visit they had all gone out to see the theatre erected in the valley. We did not, therefore, get inside, but we were the less inclined to grieve over that, since

all temples in China are more or less reproductions. The exterior view claimed all our interest and time, so unlike anything else to be seen in China. The main building, standing four-square, looks more like a mediæval castle than a temple, and is an imposing sight. Here Lamaism in inner Mongolia finds its principal home, and exercises an influence which none can fail to feel. The Lo Han Tang, at the far western end of the same valley, is notable for its galaxy of 508 Buddhist worthies, all made of wood, yet gilded to look like gold, and kept in perfect condition. The doors of this temple are usually kept locked, and opened only for special visitors. But as we were leaving we found the janitors earning an "honest" penny by allowing the people in on payment of a few cash each.

At Jehol Manchus seem to compose the larger part of the population, and of women, with their peculiar head-dress, we saw a great number at the theatre mentioned above. We also noticed that all the Manchu boys wear a plain earring in one ear, the reason given to us being that it was a preventive against disease, and commonly practised among the bannermen. The hills in the vicinity of Jehol are of quite a distinct type, assuming most unusual and fantastic appearances. One peak resembles an incense-burner, and is called Hsiang Lu Shan (Resembling Censer hill); another is named Ha Ma Shan (Frog hill), being exactly like that amphibious animal; while one hill which we passed, in the distance stood up like our own St. Michael's Mount, but when we got nearer seemed a miniature of the Giant's Causeway. All about game is found, and in great abundance, as witness the fact that in the season pheasants can be bought for a sum equal to 1*s.* per brace.

We turned our backs on this interesting district with great reluctance, but other duties called us within the wall at the end of three weeks. We finished up by sailing on a small boat down the Lan river, and although four nights sleeping under a mere awning is not so much of a joke in November as it might be in June, yet the quiet change was very enjoyable. The distance from Jehol to Lanchau is roughly estimated at 200 miles, and though that seemed to us an extravagant estimate, yet when we found how the river twists and turns in and out of the massive mountains that rise up sheer from the water's edge, we felt our Chinese boatmen were not so far wrong. The river is navigable for about 100 miles above Jehol, that is, as far as Fung-ning-hsien, and flows into the sea about 30 miles south of the railway at Lan-chau. The traffic is considerable, and the boats—rough, flat-bottomed, crazy-looking affairs—are legion. A great trade is done in timber, fruit (principally pears), peanuts, and incense powder, while kerosene oil and cottons are sent up inland. Not the smallest part of the pleasure—and risk—lies in the shooting of the numerous small rapids which are met on the river, and the alert and ingenious manner in which the boatmen manage their craft is worthy of even a Westerner's admiration. At most of

these rapids (of which in one day I counted thirty-one) are water-mills devoted to the grinding of trees to make incense. The trees are chopped into small pieces and thrown into a hole in a heavy millstone, which revolves on a larger stone as the water rushes through below. In the rainy season, when the river flows full and fast, they can grind on a pair of mills two hundred catties per day. It is made up into bundles of this weight, and sold on the spot for fifty strings of cash (about 25*s.*), whence the bulk of it is transported into Manchuria to be made up into fragrant incense-sticks. Idolatry is therefore profitable to others besides priests. The river is a sportsman's paradise. The trip down the river took four days, but was full of an ever-changing charm. We passed through the wall at Pan-chia-ko, where, as at Lŭng-ko, the tower has disappeared, carried away by floods in 1883. Late at night, on November 10, we brought up at Yung-phing Fu; next morning joined the mail-train from Shan-hai-kwan at Lan-chau; and our delightful trip of over 550 miles was a thing of the past, to remain a pleasant memory for many years to come.

A JOURNEY WEST AND NORTH OF LAKE RUDOLF.*

From Notes supplied by J. W. BROOKE.

In August, 1903, the East African Syndicate despatched an expedition to the little-known country extending north from Mount Elgon, on the west side of Lake Rudolf. Four white men were sent, one of whom, Mr. J. W. Brooke, furnishes an account of the country traversed, accompanied by a map of the route, which we here reproduce.

Mount Elgon consists of a foundation of gneiss overlaid with dust, ashes, and scoriæ; but Dabasien, a little further north, is almost entirely lava, the intervening space being occupied by a highly contorted schist with quartz. North of Dabasien there are hills some 1000 feet high, almost perfectly pyramidal, whose origin is a difficult problem. The Karamojo and Jiwi countries, through which the route lay, are mainly volcanic, being traversed by sharp volcanic dykes which rise precipitously some 500 feet out of the flat alluvial plains. Dodosi is, however, slightly more interesting. To the north-east, after a range of mountains has been crossed, the ground sinks by a precipitous step to a volcanic plain covered with thorn bush about 1900 feet above sea-level. It is only practicable just after the rains in August and September. A large river, hitherto not marked on the maps, and for which no name could be learnt, flows west from the Lubur mountains and disappears in the sands; and as the western hills also shed their water in this direction, the plain must be converted into a lake of mud during the rains. On the foothills of Lubur (which was recognized from its

* Map, p. 588.

contour as shown in Major Austin's map) shell-beds 500 feet above the lake were found, containing species identical with those in the lake, and thus proving that the levels have changed considerably. The lake is fed by numerous saline springs on the shore, as well as from the sides of Mount Lubur. The mountains round Rudolf seem slightly older than the rift-valley volcanoes, and no signs of hot springs were seen. On reaching the most north-easterly camp, two of the party ascended to the plateau, which reaches an altitude of 6000 feet, or 3000 feet higher

MASAI WARRIOR.

than the plain below. Above, the country and climate are described as the most glorious imaginable—the hills terraced from top to bottom, and springs issuing from the higher levels and trickling from terrace to terrace to the valleys below. The hills are volcanic, but much older than any seen previously.

After a westward march of 90 miles, the plateau was left and a river reached, which seemed to be the stream shown by Wellby as the upper course of his second or Western "Ruzi," though the only name

KARAMOJA WARRIOR.

obtainable for it was Koron.* Mr. Brooke thinks that it flows in a westerly direction without turning north. A salt spring in this neighbourhood was quite undrinkable, but south of the hills of Moro Agabi a clear spring of beautiful water was found. In the district of Dabossa, which was visited, the river Lora completely disappears under the volcanic soil, but its eastward course is marked for a long distance by a line of trees. The Kideppo is likewise lined with Borassus palms and thick undergrowth. On reaching Morongole, some trouble was taken to fix the position of Mount Mogila (apparently the Tirano of Dr. Donaldson Smith,† though this name was not heard), and it was

* Mr. Brooke says that the name Ruzi was quite unknown here, but it may be observed that the French traveller, M. du Bourg de Bozas, found every watercourse described as Ruzi in the Turkana country.

† *Journal*, December, 1900. Of the other place-names mentioned, the Moro Agabi hills seem to represent the Mount Agabi of Dr. Smith; while Dabossa was shown as an extensive district in Colonel Macdonald's map (*Journal*, August, 1899), and Morongole as a mountain to the north-west of Karamojo. Mounts Etus and Hogo also appear on Dr Smith's map.

found to be placed 30 miles too far north on previous maps. Mr. Brooke's map was checked by bearings (with a 5-inch compass) to known points, including Mounts Morongole, Singhoti, Etua, and Hogo (or Naita).

Of the tribes with which the expedition came in contact, the Karamojo (whose language extends up to Southern Abyssinia) are described as treacherous and of a low negro type, sooty black, though splendid runners, and averaging over 6 feet in height. They wear the Turkana pad plastered with mud at the back of the head, also iron and ivory bracelets and iron collars. They are very excitable and objectionable, and one must be careful in dealing with them. The Ijiwi * have more refined features than the Karamojo, but are equally excitable. The true Turkana (so called in distinction from the nomadic Turkana, who are a wild set of outcasts) are dark olive in colour, have aquiline features and slender limbs, though their eyes are small and fierce, possibly owing to their continual use in hunting. While in the neighbourhood of Lake Rudolf, the advance guard of an Abyssinian force was encountered, and made a favourable impression from their clean and smart appearance and courteous bearing. They are described as

FOOTHILLS OF MOUNT ELGON.

perfect riders and born soldiers, and were armed with French and Russian rifles made in about 1874. They had raided between 30,000 and 40,000

* Mr. Brooke says that this tribe is quite distinct from the Igini of de Bozas (*Journal*, vol. 21, p. 320).

GRAZING LANDS OF NAIVASHA.

head of stock, as well as a great many slaves. They were living in large, well-built huts, which they shared with their horses, and only in the case of the more aristocratic were the huts kept clean. Their women are badly treated, and do all the indoor work, while the men sleep when they are not raiding or eating. The chief articles of trade seem to be broad-brimmed hats, rugs, blankets, white linen, copper cooking-pots, swords, clocks, etc. The Marle, who live near the north end of Lake Rudolf, were found to be living on fish, their crops having been destroyed by the Abyssinians. Their huts were hidden away on little sandy hills in the dense rushes surrounding the lake.

The Tilma, Menu, and Mürrile are small tribes subject to the Abyssinians, living on grain and honey. The women all slit the lower lip and insert a plate of wood that projects 3 inches from the mouth, while the Mürrile wear curious iron chain petticoats that weigh some 20 lbs. The men are tattooed on the right shoulder, and have aquiline features, while the manner of dressing the beard and hair recalls pictures of the ancient Egyptians. The Mürrile speak the Karamojo language, and are not closely allied to the Tilma and Menu, though all have Hamitic affinities. The Dabossa people were friendly, though unable quite to make out who their visitors were. They are strong and well-made negroes resembling the Karamojo, and are quite a match for the Turkana in a fight. They wear wrist-knives, and own large numbers of fine cattle. The people of Zulia had recently been exterminated by the Dodinga. Those of Mpuri are probably Hamitic, and are friends with every one, a rare occurrence amongst these tribes, who live at constant enmity, though it is only at rare intervals that an attack in force, leading to the extermination of an unsuspecting neighbour, is made. The Mpuri live on game and on the Mwali grain that grows on the mountain-sides. They make up their forefathers' hair into the

form of a hat (in place of the pad seen elsewhere). It is ornamented with cowies, and droops down over the ears and back of the head, being plastered on with mud, which must be dissolved in water before it can be taken off.

The Karamojo were evidently once the dominant race, but as a result of rebellions, as well as of the Hamitic invasion (which would also account for the hill tribes, like the Mpuri and Mŭrrile, with their refined features), became split up into smaller tribes.

Game of all kinds abounds where there are no natives, and large herds were seen congregated around the water-pools north of Dabossa. The Steyn buck and lesser koodoo prefer dry bush-covered country, and the former were seen (together with pheasants and partridges) around dry river-beds with no water within 20 miles. They feed on the succulent cactus. Huge pythons were seen during the march to Lake Rudolf, and not far from the lake-shore myriads of bats were found living in cracks in the volcanic soil. They flew away in clouds over the lake, returning to the same spot every evening. A baboon measuring 4 feet at the shoulder was seen on the Kabeish river just south of the Abyssinian plateau, and is probably a new species. One of the party had the good fortune, also, to see a pack of wild dogs hunting. They follow their leader in single file, taking advantage of every possible cover on approaching an unwary herd of zebras. A new species of crow, with two white marks on the top of each wing, was seen on the Abyssinian highland. The party was, however, handicapped as

BASALTIC CLIFFS SOUTH OF LAKE NAIVASHA, CAUSED BY SUBSIDENCE OF THE LAND BETWEEN.

regards natural history investigation by want of time and transport facilities.

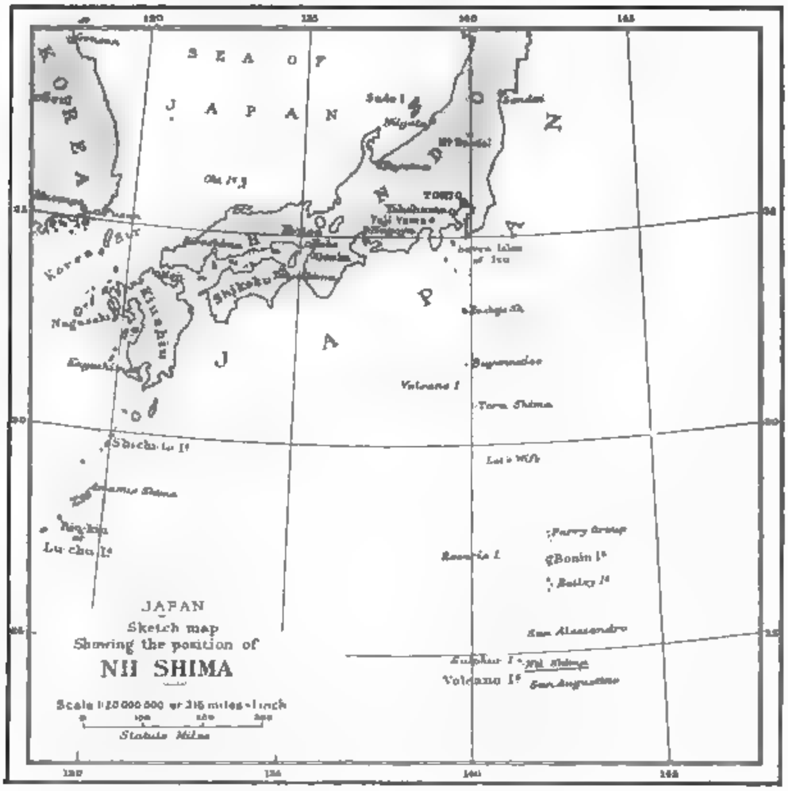
The most valuable product of the country is ivory, the exploitation of which, however, needs to be properly controlled. At present the Swahili muster in force amongst a friendly tribe like the Dabossa, and then raid the Turkana, taking stock, which they trade for ivory with friendly natives, and making slaves of the women and children. Great numbers of elephants of all sizes are killed; consequently, the export of ivory is far greater than it should be, but it is hoped that by now this may have been remedied. The Turkana country is now comparatively safe to travel through, a good impression having been made by the return of a Turkana woman who had been carried off by the Swahilis. The country round Elgon, with its abundant supply of rain all the year round on the higher ground, should be profitable to the farmer. Elsewhere the natives obtain water by digging deep wells in the river-beds. The expedition had some difficulty in regard to water-supply, but a month earlier this would not have been the case. The Swahili, though wonderful porters and splendid at roughing it, cannot be taught to pack donkeys, which are far and away the best transport-animals for this part of Africa. They are, however, liable to the attacks of the tsetze fly, to which all the animals of the expedition succumbed after reaching the Kabeish river.

A NEW ISLAND.

JAPAN is undoubtedly a land of surprises, and for sudden and violent displays of plutonic and seismic activities it would be difficult to find her equal. Sometimes she is creative and sometimes destructive, but as a builder of islands and a remover of mountains she is *facile princeps.* The "*Mons excelsus et singularis*" of Kaempfer, the Great Fuji, 13,000 feet or thereabouts in height, we are told reached its present position after a cross-country march of 200 miles in a single night. In 1888, Mount Bandai, a peaceful-looking old hill which for countless generations had smiled upon villages and lakes around its base, without warning blew off its head and half its body, and in ten minutes a well-known landmark was no longer recognizable. While Pelée was still muttering over its holocaust at St. Piérre, Japan, as if seized with an idea to keep abreast with all things that pertained to Europe, by an eruption buried all the inhabitants on Bird island (Torii Shima).

Now news reaches us from the south of Torii Shima that an island 480 feet high, $2\frac{3}{4}$ miles in circumference, has already sprung into existence. Its growth was watched by the inhabitants of Iwo or Sulphur island, near the Bonins. On November 14 they were startled

by strange rumblings. Two weeks later they saw great clouds of black-and-white smoke, or, in other words, clouds of black ash and steam. Next the sea appeared as if it were on fire. What they saw was suggestive of a fight between Vulcan and the ocean. When, in 1883, the Indian ocean poured down the red-hot throat of Krakatoa, angry resentment was announced by explosions and thunderings which were heard from the centre of Australia to the Mauritius. At Nii Shima, as the new island has been christened, although no one was near



enough to tell precisely what occurred, the struggle between the Pacific and the internal fires was conducted in a manner much less boisterous. At Krakatoa Neptune was victorious, and the sea put out the volcano; at Nii Shima, in spite of a watery load of 6000 to 10,000 feet above his back, Vulcan's head and shoulders now look round upon the Pacific. How this was accomplished without expectant ears in Japan and China picking up sounds suggestive of an engagement between opposing fleets, it is difficult to understand.

At first a little island appeared amidst the smoke. Later it seemed

as if there were three islands. On December 12, instead of three islands, one large island was seen standing in the sea. From day to day this changed in its configuration, and those who watched it were anxious as to what might happen next. To allay alarm and find out what had occurred, ten men set out in a 30-foot boat and a canoe. They reached the island on February 1, and placed upon its summit a flag with the inscription, "New place. Great Japan. Many Banzais." The south coast is reported to be a precipitous mass of rock, while on the north there is a boiling lake. After such Titanic efforts, this new addition to the empire of Japan may be expected to fly a flag of steam above its lake for many years.

If we draw a line from Fiji to Bonin, which may be continued both towards the north and towards the south, we find it is a line studded with volcanoes, and a number of these have been created within historic times. Where it crosses Japan, we see it as the "Magnum Fossa," or Great Fault, to which attention was first drawn by Dr. Edmund Naumann. Its suboceanic continuation is also a line of yielding, and it is along this that Vulcan has so often forced an opening, and in the form of islets and islands left monuments of the power that can be exerted by the imprisoned vapours within our world. Two other regions in which Japan, for similar reasons and in a like manner, is still adding to her territorial area, are to the south of Kiushiu and to the north of Yezo. In both these districts we can see these mushroom-like creations still "smoking." The Ainu name for the Kuriles, which form the northern line, means "the Smokers," while the name Kurile itself is apparently derived from the Russian "Kooreet," to smoke.

The phenomena which accompany the birth of islands, such as those which took place in the early part of this year at the birth of Nii Shima, form foundations for the same old story. At the opening of the sixth seal, as described in the Apocalypse, the Seer of Patmos recounts what we may well have seen in the Ægean sea. The sun and air were darkened by smoke from the bottomless pit; there were lightnings, thunderings, earthquakes, an atmosphere of brimstone, a hail of fire; the sun became black, a mountain was burning in the sea, and islands moved. Occurrences such as these have often been witnessed in volcanic regions, and, unfortunately, have frequently been accompanied by great loss of life. This, we are glad to say, was not the case at Nii Shima, from which the ten adventurers returned in safety.

J. M.

GLACIAL RESERVOIRS AND THEIR OUTBURSTS.

By CHARLES RABOT.

Glaciers, acting on the soil slowly but continuously in obedience to glacial dynamics, give rise from time to time to the violent torrential outbursts known in French by the name of *débâcles*. Far from being rare and accidental, as is commonly supposed, these outbursts are relatively frequent, constituting a normal form of glacial action.

The occurrence of such phenomena presupposes, first, a reservoir of water, and, secondly, its *sudden* evacuation.

The formation of the reservoir may be due to one of three principal causes—

1. The reservoir may be the result of a disturbance, effected by a temporary increase or decrease of a glacier, in the channels and outflow of streams external to it.

2. The reservoir may be the result of a disturbance, permanent throughout a period of considerable duration, effected by a glacier, in the channels and outflow of streams external to it.

3. The reservoir may be situated in the glacier itself, and its creation, as well as its alimentation, be due to the physical properties of the ice. Such a reservoir is the glacier lake, properly so called.

The first of these examples may have been produced in one of three different ways—

(*a*) A glacier, while advancing, chokes up a valley or glen at right angles or oblique to its own course, and by stopping the overflow of its waters causes the formation of a barrier lake (*lac de barrage*) during the period of advance. A well-known specimen is supplied by the Vernagt glacier in Tyrol.

(*b*) A glacier, encountering in its descent a cliff overhanging a valley, falls to pieces, which subsequently unite to form a new glacier (*glacier rémanié*) at the base of the precipice. Should the ice increase, the "*glacier rémanié*" may choke up the valley and give rise to a temporary barrier lake. The glacier of Giétroz in the Val de Bagnes is an example.

(*c*) Where, of two glaciers previously united at their lower extremity, one retreats more slowly than the other, so that the first blocks the passage of the waters issuing from the second, and compels them to accumulate in a lake. The glaciers of Otemma and of Crête Sèche in the Val de Bagnes, from 1892 to 1898, furnished a specimen of this class.

Let us now turn to our second example, in which the formation of the reservoir is due, not to glacial variations in length, but to topographical circumstances coincident with the general state of glaciation. A glacier chokes up, in a manner relatively permanent, a lateral ravine; or the ice may simply dam with its moraine a stream flowing off the enclosing mountains, thus giving rise to a Border Lake (*lac de bordure* in French, *Randsee* in German), which will endure as long as the barrier does. The best known example of the glacial *Randsee* is the Märjelen See near the Eggischhorn.

In our third example, that in which the reservoir is contained in the ice itself, three sub-varieties may be distinguished—

(*a*) When the surface meltings of the glacier fill an open hollow—a Surface Lake.

(*b*) Where a reservoir of water is formed in a hollow under the glacier—a Subglacial Lake.

Or (*c*) Where in the heart of the ice—at least in the case of the great glaciers

of the Arctic and Himalayan regions—pools of water are formed, distinguishable as glacier Ice-pocket Lakes.

The second condition required for the production of a water-burst is the *sudden* collapse of the reservoir.

The action of water on ice resembles that it exercises on limestone, as has been demonstrated by Dr. R. Sieger in his "Die Karstformen der Gletscher," in *Geographische Zeitschrift*, 1895, 3 and 4 (Leipzig). The causes which tend to the formation of rock caverns go also to the formation of glacier cavities, namely, the preexistence of fissures, erosion, corrosion, and hydrostatic pressure, to which must be added the action of air having a temperature above 32° Fahr. The waters of a glacial Barrier or Border Lake, or of a Subglacial or Ice-pocket Lake, in this way tend to scoop themselves out a passage through the mass of ice confining them. Should the opening of the passage occur suddenly, the result is a burst; but if effected gradually, the emptying of the reservoir causes no more than a marked increase in the torrent issuing from the glacier.

The force of a burst is naturally proportioned to the cube of water suddenly set free. The volume of water discharged by the burst of Giétroz in 1818 has been estimated at 5,000,000 cubic metres (1,110,000,000 gallons); that of the bursts of the Crête Sèche in 1894 and 1898 at 1,000,000 cubic metres (220,000,000 gallons). In nine hours the Märjelen See, in 1878, evacuated 7,770,000 cubic metres (1,709,400,000 gallons).*

The passage of a flood of such dimensions, impelled in most cases by a very steep slope, naturally exerts erosive and transporting force on the ground over which it sweeps. The effects of such action have hitherto attracted little attention from geologists. The following statistics of glacial outbursts may, we hope, serve to show the importance and frequency of the phenomena, as also their bearing on the study of the Quaternary rocks.

The Alps.

I. *Outbursts caused by the Emptying of a Barrier Lake produced by a Temporary Glacier Variation in length.*

1. *Glacier of Rutor.*—Val d'Aosta. A northern branch of this glacier is liable to stop the overflow of a lake in the combe of the Osselettes, causing a considerable increase in its volume. Should the waters succeed in opening for themselves a passage under the bank blocking their normal outflow, a burst ensues.

From the end of the sixteenth century to 1752, not less than fifty outbursts were produced by the Lac des Osselettes. They corresponded with the periods of advance of the Rutor glacier. Trustworthy documents record outbursts in 1594, 1595, 1596, 1597, and 1598. According to Baretti, similar accidents occurred, in all probability, annually up to 1606. A second period of frequent floods began in 1629 or 1630 and lasted till 1646, a third from 1678 to 1680, and a fourth from 1738 to 1752. The great advance of the glacier during the first half of the nineteenth century did not produce any outburst. In 1864 the Lac des Osselettes, which was then of considerable extent, gradually wore for itself an outlet by the side of the glacier, and thus drained itself gradually without causing any disaster. After De Tillier ('Histoire du Duché d'Aoste,' 1738), the Lac des Osselettes had produced outbursts before 1594, of which the dates cannot be fixed.

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* According to the calculations of Prof. Baretti, the Lac des Osselettes, produced by the dam of the Rutor glacier, discharged during an outburst 4,500,000 cubic metres of water in six hours.

A document of 1752 records the "frightful devastations" caused by these floods in the valley of La Thuile and in the valley of Aosta. They washed away the fields bordering on the river-bed, covered them with heaps of matter, and threatened the destruction of Morgex (cf. M. Barretti, "Il lago del Rutor," in *Boll. Club Alpino Italiano*, No. 41, 1880, Torino). Every time they happen, the inundations act with erosive and transporting force.

2. In 1717 the *glacier of Triolet* gave occasion to a burst. This accident was caused by the rupture of the bank confining a lake formed of the accumulated waters derived from the glacier of Mont Dolent. The inundation, following an increase of the glacier of Triolet, covered a pasture-land with "immense *débris*." This mountain pasturage is said to have been afterwards invaded by the glacier (Virgilio, "sui recenti studii circa le variazione periodiche dei ghiaccaij," in *Boll. Club Alpino Italiano*, 1883).

3. *Glacier de Miage.*—This glacier, according to Baretti, must have several times choked up the Val Veni. Thence the possibility of bursts. In a memoir published in 1867, in the *Bollettino* of the Italian Alpine Club, Canon Carrel of Aosta mentions the occurrence of such accidents, but without assigning any date to them.

4. The *Gouille de Valsorey.*—This small sheet of water, situated on the flank of the glacier of Valsorey, which, owing to the decrease of the glaciers, disappeared in 1879, has given rise to bursts. De Saussure, who visited it in 1778, reports that it was remarkable for the ravages it caused. The mass of water, he says, sometimes empties itself in a few hours with terrific impetuosity, causing an overflow of the Dranse, carrying away rocks, and producing inundations and frightful devastations all the way from the glacier whence this torrent issues to the Rhône.

Sources of information for the Gouille de Valsorey are—

(1) 'The Alpine Guide. The Western Alps, by the late John Ball,' a new edition reconstructed and revised by W. A. B. Coolidge (Longmans: London, 1898), p. 437.

(2) 'Voyages dans les Alpes.' Edition 1786, ii. S. 1013, p. 466.

5. *Glacier of Giétroz.*—In 1595 and in 1818 an increase in the volume of this glacier *rémanié* caused the Val de Bagnes to be blocked up and a lake to be formed. The dam of water attained, in 1818, a length of 2100 metres (6888 English feet, or nearly 1⅓ mile), a breadth of 200 metres (656 feet), and a depth of 55 metres (180 feet). In the above-mentioned years of 1595 and 1818, the bank of ice suddenly gave way, and there ensued a frightful flood which swept over the Val de Bagnes and extended its ravages over the whole of the Lower Vallais. Escher von der Linth estimates the volume of water let loose in 1818 at 530 millions of cubic feet (Escher von der Linth, 'Notice sur la Catastrophe de Bagnes,' in *Bibliotheque universelle de Génève*, VIII. Sciences et Arts). At the bridge of Mauvoisin the waters rose to a height of 90 feet above the normal level of the stream, while the streets of Martigny were flooded to a height of 3·25 metres (10·66 English feet).

The inundation of 1595 destroyed five hundred houses and chalets. No less disastrous was that of 1818. The flood was deeply erosive. According to an account written by the Syndics of the Valley (cf. 'Echo des Alpes' (Génève, 1887), p. 350), it seems to have even produced a displacement of the great blocks disseminated in the valleys. Moreover, as usual in such cases, "it converted the fairest pasture lands into a plain of pebbles rising to a height of 2 to 20 feet above the current. It further deposited on the plain of the Rhône a thick layer of mud, casting on it an enormous quantity of wood from the forests and chalets devastated and wrecked in its course."

6. *Glacier of Crête Sèche.*—During the great glacial retreat characterizing the second half of the nineteenth century, the glaciers of Otemma and of Crête Sèche, which in the previous period of increase formed confluent currents in their lower course, separated and withdrew each into its respective valley. The Otemma glacier having, however, receded less rapidly than its neighbour, and having dropped across the whole breadth of their ancient common valley a pile of "dead glacier" * and of moraines, the waters issuing from the Crête Sèche glacier found their way blocked by this barrier, and so accumulated into a lake. From 1894 to 1898 the evacuation of this sheet of water caused two violent floods, one in 1894, the other in 1898, to leave out of account two more that were harmless.

The accident of 1898 drifted away heavy blocks of stone and covered with layers of detritus cultivated fields and pasture lands. Lastly, at Lourtier the Dranse, quitting the bed it had followed since 1818, scooped out a new one across arable lands, and excavated it to a depth of 12 metres (39·36 feet). This last burst discharged into the Rhône an enormous mass of sediment. Prof. Oettli calculates the amount of slime borne on this occasion by the Rhône into the Lake of Geneva at 166,000 cubic metres.

7. *The Glacier of Allalin.*—When in process of increase, this glacier completely blocks the outflow of the Mattmark See, and then the rupture of the dam causes floods. Accidents of this kind happened in 1633, 1680, 1740, and 1772. The flood of 1633, destroyed eighteen houses and carried away six thousand trees in the Saasthal. It is worth while to call attention to the fact that the glacier floods traversing wooded valleys sweep off considerable quantities of trees, and then drop them in masses in regions where diminution in the slope causes an abatement in the current.

8. *Zufallferner (in the Ortler District).*—From 1887 to 1891 this glacier, with the concurrence of the Langenferner, has given rise to four bursts. The great decrease in the volume of glaciers in the second half of the nineteenth century has brought about in the upper valley of the Plima a topographical situation analogous to that of the glaciers of Otemma and Crête Sèche. The Zufallferner and the Langenferner, formerly united at their lower extremity, separated. In the open space left between the two glaciers, the waters issuing from the Langenferner formed two lakelets that flowed away below the terminal tongue of the Zufallferner, a tongue traversing the principal valley.

The Zufallferner having increased, thanks to the slight augmentation occurring at the end of the nineteenth century, stopped the outflow of the lakes, and a large sheet of water was formed behind this barrier.

The rupture of this dam caused sudden evacuations of the basin. In 1887 there was a first burst of no importance; in 1888 a second of somewhat greater force; in 1889 a third which proved disastrous; in 1891 a fourth, equally destructive.

These inundations have brought about profound modifications in the valley of the Plima. The torrent has changed its bed in the centre of the village of Gand, and has strewn over the valley enormous quantities of blocks and of detritus. "The floor of the valley is a sea of rocks" ("Die Thalsohle ist ein Steinmeer"), reports the *Mitteilungen des Deutschen und Oesterreichischen Alpenvereins*, 1891, Nos. 12 and 13.

9. *Vernagt Glacier (Oetzthal).*—This glacier, in periods of advance, chokes up the Rofenthal and, blocking the waters issuing from the upper part of the valley, forms a lake. An occurrence of this kind happened from the spring of 1600 to September 9, 1601, from 1678 to 1683, from November, 1771, to 1774, and from May,

* *Dead glacier* is ice left behind by a retreating glacier, the melting of which is delayed by its heavy cloak of morainic material.

1845, to November, 1848. During these periods of stoppage, five terrible floods were produced; on July 20, 1600; July 16, 1678; June 14, 1845; May 28, 1847; and June 13, 1848.

In 1845 the Schlagintweits estimated the volume of the lake at 7·9 million cubic metres (1,738,000,000 gallons).

The rush of these enormous masses of water must have overturned all the Pleistocene formations in the Fendthal and Oetzthal. The destructive inundations made themselves felt as far as the valley of the Inn.

During the periods of the existence of the lake its basin has, on the other hand, been the seat of an important sedimentation. Prof. Hess has estimated the volume of matter deposited during the last stoppage at not less than 723,000 cubic metres.

A part of this matter has been carried away by the glaciers from 1845 to 1848, and the rest by the torrents, after they had resumed their normal course.

10. *Uebelthalferner.*—In periods of advance, this glacier chokes the Senner Eggenthal, and thus produces a lake and then glacier floods. Such an inundation occurred in 1847. Now, in consequence of the glacier's retreat, the opening of the Senner Eggenthal has been freed, and the lake has disappeared.

The great glacier extension which occurred in the Alps in the first half of the nineteenth century occasioned the formation of a great number of barrier lakes. Thus in 1817 the glacier of Zigiorenove threw itself across the Borgne, and thus caused the accumulation of a little sheet of water above the dam (Forel, "Les variations periodiques des glaciers des Alpes," VII^e rapport, in *Jahr. d. S.A.C.*, xxii. 1866). In similar conditions the glacier of Trift has likewise given rise to a reservoir (*Jahr. d. S.A.C.*, ii. 1865, p. 61).

In any case, there is no doubt but that an exploration of the glaciers in Switzerland and in France * by scientists, and a search in the local archives, would bring to light a much greater number of such inundations than are at present known. So last summer Prof. P. Girardin discovered that during the first quarter of the nineteenth century, an advancing glacier of the valley of Champagny damned the torrent and formed a great lake. The rupture of the dam caused a terrible outburst. Traces of the lake and of the inundation are yet apparent.

II. *Floods caused by the Outflow of a Lake, independently of Glacier Variations.*

1. *Lac du Tacul:* Situated at the junction of the glaciers of Leschaux and Géant, at the northern base of the Pic de Tacul, this lake has occasioned floods at the lower extremity of the Mer de Glace ('Travels through the Alps,' by the late James Forbes. New edition revised and annotated by W. A. B. Coolidge, p. 85. London: A. & C. Black, 1900). On August 13, 1819, this Lac du Tacul gave rise to an inundation in the Valley of Chamonix (Delebecque, 'Les Lacs Français' (Paris, 1898), p. 250).

2. The *Gorner See* (not the tarn on the Gorner grat, but a pool at the base of Monte Rosa itself) causes by its evacuation an increase in the volume of the Visp. On August 23, 1900, the outflow of the lake poured into this torrent a flood of water which swept away a bridge and covered the fields with stones. The passage of this mass of water below the glacier must cleanse its bed of most of the detritus contained in it and carry it to the extremity of the glacier.

3. *Glacier of Hochbalmen.*—This glacier during the summer of 1755 gave rise

* Thanks to the late Prof. E. Richter's, of Graz, valuable book, 'Die Gletscher der Ostalpen,' on the Austrian alps, the local topography of the glaciers are better known than elsewhere.

to two floods caused by the discharge of a lake formed by it. These floods swept away a moraine and covered the cultivated lands with sand and rubbish ('Die Chronik des Thales Saas für die Thalbewohner, bearbeitet und herausgegeben von Peter Joseph Ruppen').

4. *Märjelen See.*—From 1813 to 1900, nineteen sudden evacuations of this lake under the Aletsch glacier have been recorded. In 1873 10,000,000 cubic metres (2,200,000,000 gallons) flowed away in eight hours. Such was the force of the torrent in boring itself a passage under the Aletsch glacier that jets of water burst forth through the openings of the crevasses. In 1878, 7,770,000 cubic metres (1,709,400,000 gallons) escaped in nine hours. It is evident that the passage of these masses of water must have to a considerable degree eroded the bed of the Aletsch glacier and the ravine of the Massa, the torrent issuing from its base.

5. *Glacier of Gurgl (Tyrol).*—The lake formed by the stoppage of the Langethal due to this glacier gave rise to a flood on June 30, 1717. Three hundred years previously, as reported by tradition, the Gurglerferner caused a formidable inundation brought about in the same way ('Forschungen zur deutschen Landes und Volkskunde,' vi. 4; E. Richter, 'Urkunden über die Ausbrüche der Vernagt und Gurglergletscher im 17 und 18 Jahrhundert.' Stuttgart: Engelhorn, 1892).

III. *Floods caused by Reservoirs situated on, under, or in the Glacier.*

1. *Glacier of La Rechasse (Savoy).*—In the night of September 5–6, 1899, the torrent escaping from this glacier suddenly deserted its usual mouth of outlet to issue thenceforth at a spot 300 metres (1000 feet) further off. It is impossible that the water can, in a single night, have scooped its way through a mass of ice 300 metres (1000 feet) thick. It is likely, therefore, that a network of sub-glacial passages existed at the lower extremity of the glacier of La Rechasse, and that no more was required than the rupture of one partition to divert the torrent into a new channel. This phenomenon was the reproduction on a small scale of that of St. Gervais. This hydrographic change has, of course, overthrown the moraines situated in front of the torrent's new mouth of outlet.

2. *Glacier de la Tête Rousse (Mont Blanc Chain).*—This little glacier, in the nights of July 11–12, 1892, sent forth a mass of water estimated at 200,000 cubic metres (440,000,000 gallons), producing the well-known terrible catastrophe of St. Gervais. The flood rushed with a mean speed of 50 kilometres (31 miles) an hour.

The burst widened the bed occupied by the torrent of Bionnassay, levelled part of the moraine of the Bionnassay glacier, carried away all the blocks it encountered on its passage, several of 200 cubic metres, and deposited the whole cargo, estimated at 1,000,000 cubic metres, either in the lower part of the valley of St. Gervais, where the slope diminished, or in the valley of the Arve by the village of Le Fayet.

3. *Glacier des Bossons.*—Every four or five years, according to the report of the inhabitants of Chamonix, the eastern part of this glacier gives rise to small bursts due to the outflow of sub-glacial reservoirs. On August 11, 1892, a relatively strong glacial flood was produced, which carried away a great mass of gravel and pebbles ('Ministère de l'Agriculture, Administration des Eaux et Fôrets; Exposition universelle internationale de 1900 à Paris; Les torrents glaciers,' per M. Kuss, Inspecteur des Eaux et Forêts, p. 42. Paris: Imprimerie Nationale, 1900).

4. *Glacier des Pelerins.*—According to the information which M. Henri Vallot was good enough to supply me, the small frozen sheet of water situated directly under the Aiguille du Midi and commanding Pierre Pointue gave rise to a little burst in 1898. The flood carried away the vegetation, laid bare the fixed rocks, and swept off trains of small stones and gravel.

5. *Glacier de la Neuvaz.*—On June 22, 1898, a small burst of no importance was caused by the outflow of a glacier-pocket pool. Its action, however, resulted only in the transport of sand and mud.

6. *Glacier of Festi.*—On August 1, 1899, the breach of a glacier-pocket pool caused a sudden swell in the torrent which, in consequence, carried away great blocks of stones (F. A. Forel, M. Lugeon, and E. Muret, "Les variations periodiques des glaciers des Alpes," XX^e rapport, 1899, in *Jahrb. d. S.A.C.*, xxxv. p. 215). In 1875 Sir Martin Conway witnessed a sudden swell of this torrent, connected, in all likelihood, with the evacuation of a glacier reservoir.

7. In 1899 *Zmutt glacier* set loose a flood capacious enough to cause at Sion a rise of 0·5 metre (1·64 foot) in the level of the Rhône (see authority last cited, p. 216).

8. *Glacier de Hohberg.*—On August 21, 1898, a pool of water in the interior of this glacier burst. The flood carried away a part of the moraine, swept off blocks of 50 to 60 cubic metres (*circa* 1760 to 2120 cubic feet), cut the railway from Visp to Zermatt at two points, and in both places covered the line with a layer of materials 2·5 metres (8·2 feet) deep, comprising blocks of 2 to 3 cubic metres (70 to 106 cubic feet) each (see authority previously cited, XIX^e rapport, 1898, in *Jahrb.* xxxiv.).

9. Every year the *glacier of Puntaiglas* (Tödi) swells the torrent it feeds. For twelve hours the waters continue to rise, making off with heavy materials. Thereafter they again subside.

10. *Schwenser Ferner* (*Oetzthal District*).—On July 9, 1891, the Schwenser Ferner gave rise to a flood, consequent on the evacuation of superficial cavities 35 to 40 metres (115 to 131 feet) long, and about 20 metres (65½ feet) broad. Inconsiderable mass of water though it was, it yet wrought great damage by reason of the rapidity of the slope down which it rushed. The Langgrubthal, a dale situated below the Schwenser Ferner, was covered with stones. The torrent, moreover, exerted erosive force on the banks and caused displacements. It further brought about changes in the disposition of its bed above Kurzhof (observations of Dr. Greim).

Besides the cases above enumerated, Alpine publications record various outbursts of water discharged by glaciers, the information about which is not sufficient to enable them to be traced to their causes. Thus in 1850, according to the testimony gathered by Prof. Forel (F. A. Forel, "Les Variations periodiques des Glaciers des Alpes," XIV^e rapport, 1893, in *Jahrb. d. S.A.C.*, xxix., 1894), the glacier of Tré-la-Tête appears to have given rise to a strong flood. In 1866 that of Macugnaga likewise caused an inundation, destroying a part of the moraine and covering the mountain pastures with enormous blocks of stone and with sand ("Excursion dal 1886 al 1868. Notizie dell ingegnere Felice Giordano," in *Boll. del C.A.I.* (Turin, 1868), 2 Sem. No. 13, p. 282). In 1892, again, the glacier of Weingarten on the Simplon likewise gave rise to a sudden rise in the torrent, which swept down an "enormous mass of materials" (F. A. Forel, as above cited, XIII^e rapport, 1892, in *Jahrb.* xxviii.) and destroyed the Simplon road and several chalets.

The number of floods produced by the outflow of glacier reservoirs is undoubtedly much greater than the list above adduced. It is only within the last ten years that these phenomena have been noticed. Moreover, as very frequently they devastate only the high pasture lands, they often escape attention and record.

Norway.

The great increase in the volume of Norwegian glaciers which prevailed in the first half of the eighteenth century, causing an advance on their part of 2 to 3

kilometres (1·24 to 1·86 English mile), must have given rise to numerous barrier-lakes, and consequently to frequent floods. The facts, however, have not been noted. We must therefore restrict our investigations to more recent inundations.

I. *Floods produced by Evacuation of Border or Barrier Lakes.*

1. In the Lyngenfjord chain the *glacier of Strupen* forms a border lake, similar to the Märjelen See, 1600 metres (5248 feet) according to some, 3000 metres (9840 feet) according to others, in length, and 800 metres (2624 feet) broad. On July 17, 1898, Messrs. Slingsby, Hastings, and Haskett-Smith discovered this basin, and found it full (W. Cecil Slingsby, "Mountaineering in Arctic Norway," in *Alp. J.*, May, 1899). A few days later it was found to be empty, the waters having run away under the glacier. This outflow must have produced in the lower valley, if not a flood, at least an inundation. Since, however, this lower valley is uninhabited, the event passed unobserved. Similar evacuations must happen frequently enough, as at the Märjelen See, causing erosions and transport of material.

2. The *glacier of Melkedal* (Jotunheim) blocks a lacustrine valley, open at its base, and separates Övre Melkedalsvand from Store Melkedalsvand. From time to time Övre Melkedalsvand breaks through the ice-dam and causes a burst. An accident of this nature happened in 1855 or 1856, in 1879, in 1894, and on August 11, 1901. The rush of water sweeps away all the land and vegetation in its course, and rolls down blocks as "large as houses."

3. The *Rembesdalskaak*, a branch of the Hardangerjökull, in the same manner as the Strupen, causes a border lake, and called the Dæmmevand. Whenever its evacuation is brought about suddenly, it produces floods in the lower valley, the Simodal. Such an occurrence happened in 1891, 1892, and 1893. The inundation of 1893 was particularly terrible. "Everything the torrent encountered on its course—bridges, trees, blocks of stones—were swept off and scattered in the valley. The trees along its line of route were torn up and borne away. Prairies and natural-grass lands were, in places, covered with great blocks. The Simodalsfjord, into which the torrent empties, became, it is said, so filled with floating wood that the mail steamer had to describe a semicircle round the obstruction, and was unable to put in at the entrance of the Simodal (Vibe, 'Söndre Bergenhus Amt.,' p. 244 : Kristiania, 1896).

II. *Floods caused by Evacuation of Reservoirs situated on, or in the Interior of the Glacier.*

1. On July 1, 1904, in the district of Lunde, M.E.A. Martell saw an avalanche of ice fall from the upper portion of the Jostedalsbræ. Through the gaping hole left by the severance of the ice there burst forth an enormous waterspout. This is a conclusive proof of the existence of sub-glacial or glacier-pocket reservoirs (E. A. Martel, "Ruptures de poches d'eau des glaciers," in *La Nature*, Paris, No. of 25 Mars 1895).

2. In 1900 and 1903, the *Tunsbergdalsbræ* produced a great flood caused by the outflow of a sub-glacial lake. This sheet of water is formed under a tributary of the Tunsbergdalsbræ, the Store Brimkjedlebræ, at the junction of the two glaciers. It is probable that the bed of the Store Brimkjedlebræ presents a depression favouring the union of the waters. The formation of the lake is a consequence of the actual retreat of the glacier. The Store Brimkjedlebræ being no longer able to fill up the depression it formerly occupied, the void thus left by it is occupied by the waters in question.

The inundation of 1900 has caused a displacement of the junction of the

torrent (Tunsbergdalselv) with the main watercourse in the Jostedal valley, the junction being situated 15 kilometres (9 miles) from the glacier. The floods have done no more than transport mud and gravel (J. Rekstad, "Opdæmning ved Tunsbergdalsbræen, i Sogn," in *Naturen*, Bergen xxv., No. 3, March, 1901, and xxviii., No. 1, January, 1904).

III. *Floods the Causes of which are unknown.*

1. The *Kvalvikselv*, fed by the glaciers of the Ruksisvagge and of the Goalssevaggegaisse (Lyngenfjord), sometimes undergoes sudden swellings ('Beskrivelse af Tromsö Amt.,' p. 10: Christiania, 1870).

2. The glacier of *Vetlefjord* (Jostedalsbræ) gave rise in 1820 to a flood which overturned and scattered the moraines and destroyed the forests and dwelling-places in the valley. In 1868 the traces of this catastrophe were still discernible (C. de Sene, 'Le Névé de Jostedal,' p. 10: Christiana, 1870).

3. Towards 1830 the glacier of Kjærringbotn (Folgefond) discharged a flood of water which covered the banks of the torrent with gravel, sand, stones, and blocks of ice (Sexe, 'Om Snebræen Folgefond,' p. 15: Christiania, 1864).

4. In 1857 the *Buerbræ* (Folgefond) launched a similar mass of water (see authority last cited).

5. In 1893, the *Riingsbræ*, on the Horungtinder, was pierced at its lower extremity by a long tunnel. The natives ventured into this cavern to a distance of several hundred yards, when they were stopped by a deep body of water (W. Cecil Slingsby, "New Expeditions in 1894, Norway," in *Alp. J.*, No. 127, February, 1895). Perhaps it had given passage to an outburst.

ICELAND.

The glaciers of Iceland, the most extensive in Europe,* produce floods so terrible and so frequent that the Icelandic language has a special word, *jökulhlaupt* ("glacial outbreak"), to denote this phenomenon.

The "Jökulhlaupt" are the products of phenomena of two different kinds. Several Icelandic *ice-caps* are pierced by volcanic craters. When one of these volcanoes is in eruption, it dislocates the glacier, melts it, and causes the outflow of veritable deluges of ice, water, and blocks of stone. By the side of these "Jökulhlaupt" of volcanic origin, there are others of sufficient frequency, plainly of glacial origin, produced by the outflow of barrier or border lakes or glacier reservoirs. These floods, though less powerful than the volcanic Jökulhlaupt, are yet, in a singular degree, more important than those produced in the Alps. So frequent are such outbursts, that Sveinn Pálson, an Icelandic scientist, who observed very accurately the glaciers of Iceland from 1792 to 1794, names these floods ordinary jökulhlaupt, and the volcanic jökulhlaupt extraordinary jokulhlaupt.

Dr. Thoroddsen, the eminent Icelandic geologist, and the man most conversant with this island, enumerates the following glaciers as productive of glacial "jökulhlaupt":—

(1) *Solheima Jökull* (massif of the Myrdals Jökull). The floods are due to the outflow of a *Randsee* (or border-lake). They often occur several times in one summer. "The flood of water levels the moraines and transports their materials into the bed of the torrent, which sweeps off to the sea an enormous mass of gravel, drift-ice, and vast blocks" (Thoroddsen, "Rejse i Vester-Skaptafells Syssel paa Island i Sommeren 1893," in *Geogr. Tidsk.*, 1893-1894, xii. 7, p. 171).

* The most extensive glacier, the Vatnajökull, has an area of 8500 square kilometres (3281 square miles).

(2) The south-west branch of the Vatna Jökull, which feeds the Djupa, likewise gives rise to floods, consequent on the evacuation of a border-lake.

(3) A lake situated on the same glacier, at the foot of a *nunatak*, also produces inundations.

(4) The Skeidarar Jökull (south slope of the Vatna Jökull), when swelling, bars the courses of the Sula and the Nupsa, and causes the formation of barrier-lakes, and consequently of outbursts. In 1892 this glacier launched a frightful "jökulhlaupt," due, in the opinion of Thoroddsen, to the outflow of enormous masses of water contained in the interior of the glacier or on its surface. The flood wrenched considerable projections from the Skeidarar Jökull, and covered with drift-ice large spaces between the glacier and the sea. At one point these formed a barrier 7 kilometres (4·35 miles) broad. Many of the blocks had a height of 15 to 20 metres (49 to 65½ feet). This mass of ice, blackened with sand, gravel, and lumps of rock, looked like a lava torrent. The inundation affected a territory of 600 to 700 square kilometres (231 to 270 English square miles). Consequent on this burst, several watercourses changed their direction" (*vide* Thoroddsen, 'Rejse i Vester-Skaptafellsyssel,' p. 196).

(5) The Breidamerkur Jökull gives rise to barrier lakes, the sudden outflow of which produces floods.

(6) Another branch of the Breidamerkur Jökull, which feeds the Jökulsá da Breidamerkursandi, gives rise to "jokulhlaupt" (Sveinn Pálsson, "Försog Til en Physisk Geografisk, og Historiske Beskrivelse over de islandske Is-biœrge, I Anledning af en Reise til de fornemeste deraf i Aarene 1792 til 1794," in *Den Norske Turisforenings Aarbog* for 1882, p. 37: Kristiania).

(7) The eastern branch of the Heinabergs Jökull, barring a lateral valley, forms a lake, and, on the breaking through of the glacier dam, a flood. Near the torrent the sand shows circular cavities hollowed out by the melting of the blocks of ice carried away and stranded by the flood (Thoroddsen, "Fra det sydöstlige Island," in *Geogr. Tidsk.*, xiii., 1895–1896, 1 and 2, p. 8).

(8) On the north-east slope of the Vatna Jökull, the variations in length of the glaciers cause the formation of extensive barrier lakes, the evacuation of which is not brought about without floods (Thoroddsen, 'Islands Jökler i Fortid og Nutid,' p. 16, separate impression).

The whole area lying between the Vatna Jökull and the sea, as also the coast land to the south-east of the Myrdals Jökull, is composed of sand, in great part of glacial origin. The "Jökulhlaupt," passing through this territory of characteristically loose build, are incessantly overturning its soil. In one case, moreover, they hurl into the sea enormous masses of heavy material. These constitute the understratum of new deposits to be added to and built up by slow stages. The "Jökulhlaupt" are thus one of the most powerful agents in the formation of these lowlands.

Spitsbergen.

During the few weeks of the Arctic summer, from June 15 to August 15, the glaciers of Spitsbergen generally, but especially those in the western part of the archipelago, are subjected to intense fusion. As we are told by Sir Martin Conway and Prof. E. J. Garwood, the glaciers are furrowed by copious torrents, floating large masses of melting snow. There is accordingly a superabundance of water for the formation of barrier and border lakes, as also of numerous sub- and intra-glacier pools, which in emptying themselves give rise to floods. In the interest of the science of glaciers, the explorations of Sir Martin Conway and Prof. Garwood have therefore been specially important. On the Nordenskiöld glacier,

as also those in the neighbourhood of King's bay, these travellers encountered frequent border lakes and surface glacier pools, and have determined the effects of their floods. These effects consist mostly in the transport of glacial materials, their transformation, and their accumulation at certain points. Thus the outburst of a border lake on the King's glacier carried away into the ice-tunnel by which it emptied itself, rubbish and materials belonging to moraines. "The direction of this channel was at right angles to the main lie of the valley, so that, on the valley becoming free of ice as the climate ameliorated, this water-worn glacial material would be deposited as a gravelly ridge running roughly at right angles to the valley and forming a kame" ("Additional Notes on the Glacial Phenomena of Spitsbergen" in *Quart. Journal of the Geological Society*, November, 1879, lv. p. 686). This observation of Prof. Garwood's is very important, and should cast distrust on the method which consists in diagnosing the origin of Pleistocene substances according to their facies.

Greenland.

On the west coast of Greenland, up to 72° 25′ N. at least, the inland ice experiences, from the first half of June to the beginning of September, an ablation of the most intense kind, resulting in the formation of a very great number of glacial torrents and of glacier surface lakes. The surface of the inland ice is, so to say, cut up with watercourses, which leave between them hillocks of ice. It looks like an archipelago divided by a network of canals. The maps of the border of the inland ice, again, prepared by the Danish officers, show the frequency of border lakes in this region. All the conditions, therefore, are present for the production of frequent floods. If we hear but seldom any mention of this phenomenon in Greenland, the reason is that, the country being, so to say, a desert, such inundations mostly pass unobserved. The accounts of Danish explorers, who within the last twenty-five years have studied the western skirts of the inland ice, leave no doubt as to the frequency of this phenomenon. Jensen, for example, reports that the Tasersuak, barred by the ice of Frederikshaab, will produce outbreaks ('Meddelelser om Grönland,' i. p. 43: Copenhagen); how such floods are also produced by two lakes to the east of Godthaab (*ibid.*, viii. p. 88), and by a fourth basin situated on the inland ice to the east of Strömfjörd, 66–67° N. (*ibid.*, viii. p. 66). One day, reports this officer, Eskimos were hunting in a valley beneath the inland ice. Suddenly the torrent began to swell, inundating the valley and drowning one of the hunters. Another time the inundation of a torrent issuing from the inland ice, probably caused by the yielding of a glacier-barrier, carried away four oumiaks (Greenland boats), which their owners had drawn up on the dry land a long way from the river ('Meddelelser om Grönland,' i. p. 132). These accounts prove the existence of glacial floods in Greenland.

Alaska.

Hitherto no glacial outbreaks have been reported from Alaska, but that is no reason for assuming that none occur. In fact, the reservoirs necessary for the production of such inundations are very abundant in that region; barrier and border lakes, as also glacier lakes proper. One of the affluents of the Stikine river, for example, is obstructed by a glacier. After noting this topographic fact, Prof. Israel Russell adds that basins of water of this kind are common in the region lying farther to the north ("The Glaciers of North America," in the *Geogr. Journ.*, xii., December 6, 1898, p. 558). One of the branches of the Muir glacier forms a barrier-lake 6·5 kilometres (4 English miles) long and 600 metres (1968 English

feet) broad. Between the Chaix and Hitchcock hills and the Malaspina glacier are numerous border lakes. What happens in the glacier *massifs* of the rest of the world must likewise happen in Alaska—glacier floods. The lakes in Alaska empty themselves frequently, and in emptying themselves they cause glacier outbursts.

The Himalaya.

The high valleys of the Western Himalaya and the Karakoram are, as is well known, traversed by torrents of mud, called by the natives of Baltistan "shwas," and analogous to the torrential "lave" of the French foresters in the Alps. If in many cases these "shwas" are due to the dilution of glacial mud, encumbering the high Himalayan valleys, with the melting from the snow and ice, they are also very frequently produced by glacier outbreaks, properly so called. On this last point, all the explorers of the Kashmir glaciers—Colonel Godwin-Austen, Sir Martin Conway, and Prof. Norman Collie—are agreed. In these regions inundations produced by the outflow of glacier lakes are extremely frequent, and to be regarded, not as an accident, but rather as a normal occurrence.

I. *Floods caused by a Barrier-lake due to Glacier Variation.*

The high valleys of Kashmir are, in general, very narrow, and their lateral crests, from the great altitude they attain, are clad in extensive glaciers. As often, therefore, as the lateral glaciers make a rapid advance, they bar the principal valley, and there give rise to the formation of lakes, which, in turn, produce floods. Such is the situation in the case of the glacier of the Tashing, which in 1850 blocked the valley of Rupal (Norman Collie, 'Climbing in the Himalaya and other Mountain Ranges.' Edinburgh: Douglas, 1902). Such is equally the case with the great glacier of Biafo. This latter glacier, when in advance, closed the valley of Braldoh, and led to the formation of a barrier-lake of "several miles long," the sudden outflow from which produced a terrible flood. It was to an inundation of this kind, in all likelihood, that was due the destruction of a village reported by local tradition. The inhabitants, when relating the event to Godwin-Austen in 1861, referred its date to two centuries before that time.

II. *Floods caused by Lakes independent of Glacier Variations and by Glacier Lakes.*

The great glaciers of the Karakoram—the Baltoro, Biafo, Hispar, etc.—are, together with the Seward of Alaska, the greatest ice-streams of the Alpine type at present in existence. These enormous streams, 50 to 68 kilometres (31 to 42 miles) long, have a very gentle slope, averaging 3·5°. The lower limit of the *névés* is accordingly found at a very great altitude, 5700–5800 metres (18,696–19,024 English feet) on the Baltoro in 1902 (Dr. Jacob Guillarmod, 'Six mois dans l'Himalaya.' Sandoz, Neuchâtel). A vast surface of ice thus lies exposed to fusion, a fusion all the more intense inasmuch as the climate is very hot. During his stay of nine weeks on the Baltoro, Dr. Jacob Guillarmod found the daily maximums invariably above 32° Fahr., and frequently saw the thermometer mount to 68° Fahr., as also four times to 95° Fahr. Under these conditions, the melting is very rapid, and consequently the glaciers of the Karakoram are furrowed by numerous and powerful torrents, while beside their banks flow copious water-courses. These rivers give rise to numerous border and glacier surface lakes.

On the Hispar, Sir Martin Conway reports frequent surface sheets of water. On the glacier of Punmah, Godwin-Austen encountered several surface glacier lakes, and also border lakes. In 1861 the Baltoro comprised numerous surface

basins 450 metres (1476 English feet) long by 60 to 90 metres (196 to 295 English feet) broad. On the passage of the Conway Expedition of 1892, these bodies of water were no less abundant than in 1861. In 1902, Dr. Jacob Guillarmod record the presence of frequent border and glacier surface lakes. The phenomenon is therefore a constant occurrence on this glacier.

It appears that the great glaciers enclose, besides, glacier pocket reservoirs. Twenty-two kilometres (13¾ English miles) from the front of the Baltoro, M. Guillarmod found a basin of considerable dimensions, which had emptied itself by a fissure at the bottom. On one side of this basin there opened, in the thickness of the glacier, a cavity more than 30 metres (98 English feet) deep, which no doubt served as bed of an intra-glacier torrent.

Colonel Godwin-Austen noticed that the glacier surface cisterns often emptied themselves in a night, and then filled again very rapidly from the contributions of numerous inter-glacier drains. On the sides of these cisterns, he relates, are little holes, through which the water runs out as through so many taps.

On the glacier of Biafo, again, Mrs. F. Bullock Workman reports irregular openings, the diameter of which does not exceed the breadth of a human head, leading to profound abysses.

All these border and glacier lakes empty themselves at irregular intervals. The arrival of the floods of water at the lower extremities of the glaciers is a signal for the issue of torrents of mud. In the environs of the village of Tisir, in the valley of Basha, Godwin-Austen saw the fields covered with sand, detritus, and great blocks of stone, eight or ten houses buried, and great trees overturned. The disaster was the effect, so the natives told him, of a flood caused by the sudden evacuation of a glacier lake. Whoever has not witnessed one of these floods, writes this admirable observer of glaciers, can form no idea of the transporting power of those masses of water and melting snow.

The floods level the moraines, sweep away their materials, push before and with them all the blocks of stone they encounter, and carry off an enormous mass of mud. There is no need, however, to exaggerate the power of these phenomena. Their effects are strictly limited to the valley bottoms. Godwin-Austen estimates the breadth of the "shwa" he witnessed at 27 metres (88·58 English feet), and its depth at 4·5 metres (14·76 English feet). Conway reckoned the "shwa" he witnessed at 12 metres (39·37 feet) broad.

This long catalogue may show that glacial outbursts are produced in all regions covered with glaciers, and that their frequency is proportioned to the extent of the glaciers. In the Alps, where glacial phenomena are reduced to a very small compass in comparison with their development in the Karakoram, Alaska, Spitsbergen, and Greenland, no less than nineteen such outbursts have been duly authenticated since 1890.

These inundations exert considerable erosive power, modify markedly the line of the valley bottoms they follow, in the way both of enlargement and of displacement. They also exert important transporting force, displacing great blocks and carrying away enormous masses of mobile material, which they accumulate at the mouths of glens opening into the principal valley, and at points where the slope suddenly lightens. Consequently, in the valleys subject to these phenomena the actual glacial formations are transported to a distance, and receive a new facies, while the Pleistocene deposits are refashioned throughout the whole zone touched by the inundation. It has to be further observed that the floods destroy the forests they overtake, and deposit enormous quantities of wood on the places where they stop or lose velocity. The catastrophe of Giétroz in 1818, for example, floated

into the valley of the Rhône vast masses of wood. A part of it was derived from the destruction of a great number of chalets. The inter-glacial lignites might be traced to this origin.

The action of bursts may be compared to that of the shoots of water artificially produced in some of the ports on the French coast of the English Channel, in order to clear their entrances of pebbly obstructions and throw them back into the deep sea.

These inundations must have been produced in the Glacial period under the same conditions as to-day in Greenland and other Arctic regions. This being incontestible, it is in our opinion proper to observe a very great reserve in determining the origin of the Quaternary formations. In a number of cases geologists are certainly in error in attributing exclusively to glaciers formations which are the combined product of glaciers and of running waters. The "fluvio-glaciaires" deposits cover a greater surface than "formations glaciaires" properly so called. The part played by floods issuing from glaciers has hitherto been too much neglected. Now, in our opinion the part played by such waters is considerable. The water circulating under the glacier is charged with mineral particles. It is thus a particularly active agent of erosion. When it runs in a broad bed, the water acts as a polisher; perhaps many *roches moutonnées* result from this effect of the glacial waters; when enclosed in a ravine, it acts as a saw; lastly, when a great flood of water is produced, it transports to a distance materials supplied to it by the glacier, and with these materials it fills all the depressions it meets.

We must not, however, go from one extreme to another, and we must guard against exaggerating the effects of glacial outbursts. In the present epoch they affect only the banks of the river-beds and the lower parts of the valleys; during the Quarternary period their power was also limited to the valley bottoms they followed.

NOTE.

By Douglas W. Freshfield.

M. Charles Rabot's article, and the copious statistics with which it is accompanied, will, I trust, fulfil his object by attracting the attention of glaciologists, geologists, and travellers to the class of catastrophes which he describes. Heim has well compared a glacier to a sledge, which, picking up the heavy burden entrusted to it by the forces that split the mountain cliffs, carries down its load slowly to the valleys. We may, perhaps, compare these torrential outbursts to a motor car, which, catching up a portion of the packages, whirls off with them to the spot where the diminution of the slope puts an end, if not to its own progress, to its carrying power. I tread with trembling on the confines of geology, but I shall hardly be wrong in endorsing M. Rabot's argument that the effects of these outbursts in past times of more extensive glaciation in the Alps must have been on a scale vastly in excess of what we witness to-day, and that sufficient attention has not hitherto been paid to them as agents in earth-sculpture. Is it not possible that a certain number of the more lowlying so-called "erratic blocks" may have been caught up by these floods and carried to their present positions? The suggestion seems at least worth considering. I should further like to point out the undesigned coincidence of M. Rabot's reference to the saw-like action of subglacial torrents with a passage in my address, printed in the October number of the *Journal*.

I am unwilling to add to the length of M. Rabot's valuable and suggestive paper. I will, therefore, only mention here, without going further into detail, the two very important catastrophes recorded in recent times in the Caucasus: the periodical outbursts proceeding from the Devdoraki glacier under Kasbek

in the middle of the last century, which on more than one occasion destroyed the Dariel road, and the great flood of the torrent of the Gezel Don glacier in the same district in 1892. In the Sikhim Himalaya under Kangchenjunga I did not discern any traces of changes brought about by the sudden collapse of lakes, the origin of which was due, in one way or another, to glacial action. There was no scarcity of glacial surface lakes and barrier lakes, but, owing partly perhaps to the warmth and perennial rainfall, they appear to drain themselves in a less spasmodic manner.

THE INDIAN EARTHQUAKE.

On April 4 a severe shock of earthquake visited northern India, doing an immense amount of damage, principally at Lahore, Mussuri, and Dharmsala, and causing a lamentable loss of life. At Lahore the cathedral was seriously damaged, as well as the Juma Masjid, one of the finest mosques in India, and many other buildings, both public and private. Some loss of life occurred here, but this was far exceeded at Dharmsala, where both the cantonment and civil station were practically destroyed, many Europeans being among the victims. Owing to the collapse of the stone-built barracks, the Gurkha regiments, especially the 7th Gurkhas, suffered terribly, no fewer than 470 in all being killed. At Kangra three European missionaries were among the victims. Other places at which damage was done were Delhi, Amritsar, Dehra Dun, Amballa, Simla, and Srinagar, though at none of these was the loss of life exceptionally high. The disastrous shocks, which seem to have been repeated several times, occurred in the early morning of the 4th, but further slight shocks are said to have been felt during the following night.

The following remarks are made by Mr. R. D. Oldham:—

The telegraphic reports enable us to form an approximate idea of the magnitude of the earthquake. It undoubtedly ranks as a great earthquake, whose violence exceeded 10 degrees—the maximum of the accepted scales of earthquake classification—over a considerable area, but it was far from coming up to that of 1897 either in extent or violence. It is too soon to form an estimate of the latter, but the extent of country over which it was felt cannot have been more than one-quarter of that affected in 1897, though the death rate was probably more than four times as great. The focus evidently lay in the Kangra valley, or between it and the Dhaoladhar range, but, if newspaper accounts are to be trusted, the shock seems to have been more violent at Mussuri than would have been anticipated, and this suggests the possibility that it originated in a movement along the great boundary fault of the Himalayas; it will be interesting if the investigation, which we may trust the Indian Government to make, should establish a renewal of movement along this great structural feature which has played an important part in the elevation of the Himalaya.

The following comments on the earthquake have been sent by Dr. Charles Davison:—

At or shortly after 6 a.m. on April 4 North-West India was visited by one of those great earthquakes which not only devastate extensive areas, but give rise to undulations that are recorded by seismographs in every part of the globe. During the previous night two slight shocks were felt at Mussuri, and probably also at other places; but the great earthquake itself occurred so suddenly and with so little warning that most of those indoors were unable to escape. The position of the epicentral district is still unknown, but it probably includes the towns of Dharmsala, Kangra, and Palampur, which are situated about 160 or 170 miles

east-north-east of Lahore. At these and several other places the destruction of buildings was practically complete, and the loss of life very considerable, though fortunately less than was at first supposed. That the number of persons killed must amount to several thousand there can, however, be little doubt.

The area within which buildings were damaged is of unusual extent. To the north, west, and south it includes Srinagar, Rawul Pindi, Lahore, Ferozpore, Patiala, and Dehra Dun. Even so far to the south as Delhi many buildings were injured, though without any accompanying loss of life. Towards the east the boundary of the area of destruction is still undefined; but if, as is probable, Dharmsala lies near the epicentre, it must pass not far from Leh, in Laduk. Bearing in mind the uncertainty of our data, a first estimate would give about 520 miles for the length, 360 miles for the width, and 150,000 square miles for the area of the region within which serious damage occurred to buildings and property.

Still more uncertain is the extent of the total area disturbed. For about half its course the boundary of this area traverses countries from which all observations of scientific value will be found wanting. It is reported, but the report requires confirmation, that the shock was felt very slightly at both Bombay and Calcutta, the former of which is about 980 and the latter about 1020 miles from Dharmsala. If we take the latter figure for the radius of the disturbed area, the total region over which the shock was sensible must have been about 3¼ million square miles, or not much less than the area of Europe.

In its great duration, the recent earthquake resembled other shocks of the first magnitude. At Mussuri it lasted quite three minutes, though one estimate is as low as one and three-quarters, and another as high as five minutes. Possibly the originating movements were not uninterrupted, and in times of terror all estimates are liable to exaggeration; but hardly any feature of the shock bears such eloquent testimony as this unusual duration to the vastness of the seismic focus or the magnitude of the forces that are capable of giving an impulsive thrust to so large a portion of the Earth's crust.

To suggest any definite cause as the origin of the earthquake may be at present premature. But one fact worthy of notice is the elongation of the area of great destruction in the direction of the Himalayan axis. This seems to point to an intimate connection between the earthquake and the growth of these ranges, either by a series of fault-slips, or, as Mr. Oldham suggested for the Indian earthquake of 1897, by a slide forward along a thrust-plane, accompanied by secondary, but by no means unimportant, slips along the faults that branch up towards the surface.*

REVIEWS.

EUROPE.

City Development.

'City Development.' By Patrick Geddes. Edinburgh: Geddes & Co. 1904. *With Plan, Perspective, and 136 Illustrations.*

This finely illustrated volume embodies the suggestions made by Prof. Patrick Geddes to the Dunfermline Carnegie Trust for the beautification of the city and the promotion of its civic usefulness. Taking his stand, as a geographer, on the natural features of Dunfermline, "the fort on the crooked water," the author shows how many of these, and particularly the "crooked water" itself, with its

* We hope to publish in the June *Journal* a reproduction of Dr. Davison's record of the earthquake.

glen, could be made to contribute in the most striking manner to the beauty and special character of the city. His scheme further includes the laying out of a spacious park, with botanic and zoological gardens, lawns, and shady alleys, formal gardens and wild gardens, orangeries and pine woods, as well as vistas and avenues framing the beautiful architectural perspectives which the city offers.

As a promoter of city improvements, Prof. Geddes is known to be both conservative and courageous. He "would respect and preserve examples of honest and characteristic work of each and every period, whether from our present point of view it seems beautiful or not." Each survival of the past is consequently to be looked at as an actual or possible asset. This method is admirably illustrated by a remarkable series of pairs of photographs, one of which shows a portion of Old Dunfermline in its present neglected condition, while the other, by a skilful process of retouching, shows how it may, without destroying any of its essential features, be modified into a harmonious whole.

Among the most interesting features of a book to whose suggestiveness in many directions no justice can be done within the limits of a brief notice, is the proposal for a series of culture institutes which shall express the many sides of complete civic life. These would include, not merely the conventional library, picture gallery, and scientific museum, but nature museums, labour museums, open-air museums, historical institutes, and art institutes, all expressing in their structure those synthetic ideals which Prof. Geddes has long striven to popularize, while another group of social institutes would emphasize the needs of man, woman, and child in their individual, as well as in their corporate capacity. Into the vistas which these open out it would be rash to enter, but in the *Geographical Journal* attention may fitly be called to the nature palace of geography. Here are gradually to be collected and properly oriented a series of typical landscapes or panoramas similar to those which delighted so many visitors to the last Paris Exhibition.

"The visitor, entering at the north and keeping his left hand to the east, so as to travel with the sun, would thus pass through the characteristic landscapes of the Old World. He would begin, say, with Nansen's ancient ice; pass to Lapland, with its Lapps and reindeer; descend to the pine forests of Norway, with its sturdy woodman, its boat-builder on the fiord; thence through Denmark or North Germany to the alpine landscape; thence again to Italy, to South Italy or Greece, to Asia Minor or Syria. A series might lead through Mesopotamia, Persia, the Himalayas, and India to Ceylon; another through Manchuria, Korea, and Japan, through China, Burma, and the Malay peninsula; yet another to and through Australia and New Zealand. Or, coming down again from the north upon the western hand, he would similarly start with a Greenland or Alaskan glacier and the Eskimo encampment at its foot, and pass, by a Canadian forest and lake scene with its half-breed trapper, to the vast wheatfields and orchards of Manitoba, or the apple orchards around Quebec. From a farm scene of New England he would pass to the cotton and tobacco plantations of the Southern States, and thence again to the great swamps of Florida, or the orange groves and ranches of California, and once more to the gorgeous cañon architecture of the Yosemite, to the mighty trees and the cactus desert."

Similar series are planned to illustrate the other regions of the world, while a great globe, showing the physical features in relief, would help to correlate these varied impressions. With such a graphic representation of the wonders of the world, one can imagine Dunfermline becoming the Mecca of the geographical teachers of many lands.

At a time when many cities, and notably London, are paying by costly schemes

of rebuilding for the fortuitous methods of expansion permitted in the past, such a book has a special interest. Those who attended the economic section of the Cambridge Meeting of the British Association will remember that plans were exhibited, which had been prepared for reference by German cities, many years in advance, to secure expansion along lines at once beautiful and hygienic. Prof. Geddes is, we believe, the first to attempt to do the same for any city in this country, and whether readers agree with his detailed suggestions or not, few will deny that such surveys, by men of wide culture and experience, are necessary if our rapidly growing towns are to expand into dignity and beauty instead of into chaos and slumdom.

ASIA.

The Literature of the Mission to Lhasa.

'Lhasa.' By Perceval Landon. 2 vols. London: Hurst & Blackett. 1905. *Maps and Illustrations. Price* 42*s. net.*

'Lhasa and its Mysteries.' By Colonel L. A. Waddell. London: Murray. 1905. *Maps and Illustrations. Price* 25*s. net.*

'The Unveiling of Lhasa.' By E. Candler. London: E. Arnold. 1905. *Map and Illustrations. Price* 15*s. net.*

'To Lhasa at Last.' By Powell Millington. London: Smith, Elder. 1905. *Price* 3*s.* 6*d. net.*

The future historian of the twentieth century will suffer from no lack of material in compiling his chapter on the British Mission to Tibet of 1903–4. Two substantial Bluebooks provide much curious geographical and diplomatic matter. In addition to these four works, two of them substantial in size, have already been issued by eye-witnesses of the campaign. It may be convenient here to notice them together.

The more important volumes are those of Mr. Landon, who was the *Times* correspondent with the Mission, and Colonel Waddell of the Army Medical Service, the author of 'Among the Himalaya,' who by long study and travel has made himself a master of the Tibetan language and literature, and an authority on Buddhistic lore and ritual.

There is inevitably a good deal of repetition in the several volumes, as regards the events of the campaign and the scenery and buildings described. Both writers give in detail the incidents of the march, of the sieges, first of our own force and then of the Tibetans, at Gyangtse, and of the protracted negotiations at Lhasa. Yet they supplement one another in many particulars, for they observe from different points of view.

To Mr. Landon the reader will go for a consecutive history of the expedition and the affairs which led up to and concluded it. For, having no fear of the censorship of superior officials before his eyes, he can comment on as well as describe the conduct of the Mission with a freedom denied to those engaged in Government service. And he saw somewhat more of the fighting than his fellow-authors, as he alone was present at the first battle on the Karo La. Both writers make clear that the slender force left at Gyangtse while this operation was undertaken had a very narrow escape from annihilation, and that the Tibetans laid a trap which, with a little more determination on their part in the night assault, might easily have proved fatal to Sir Frank Younghusband and his escort.

To Colonel Waddell the student will naturally turn by preference for accounts of the political institutions of Tibet, for interesting interviews with its priests and statesmen, for the comments of an expert on the religion and customs of the

country, for the translations of local names—the Tibetans set us an example in picturesque nomenclature—and last, but not least, for the collection of Tibetan proverbs with which he has headed his chapters. Here is a specimen, "It is no use trying to tug the glacier backwards."

In his descriptions of scenery and buildings Mr. Landon has been at pains to supply and emphasize local colour, to convey to his readers vividly and precisely his own impressions of the strange sights of the road. He has an excellent eye for nature, and a considerable talent for reproducing effectively picturesque detail both in landscape and architecture. Nor is similar praise to be denied to Colonel Waddell, though in some instances his sentences show signs of hurried composition. Colonel Waddell sees a Tibetan temple with the eyes of a Buddhistic scholar, Mr. Landon with those of a decorative artist. As a rule, their accounts coincide with or supplement one another. But in one instance at least, and that an important one, their impressions of the famous Buddha of the inner sanctuary of the Jokang, or great temple of Lhasa, they are in amusingly direct contradiction. And in his account of the interior of the Potala palace, Colonel Waddell is the fuller and the more appreciative. It will be obvious that readers seriously interested in Tibet should study both works. The passages quoted below may show that the labour will not be increased by any lack of literary skill on the part of their authors. The following is Colonel Waddell's description of the "suburbs of Gyangtse in spring," which may help to dispose of "the fallacy that Tibet is a vast hilly and barren country, peopled by roving pastoral tribes."

"It was a perfect spring morning. All nature was vibrating with the joy of new-found life. The frost-bitten land had thawed under the few weeks' genial sun, and through the soft soil by the roadside and on the borders of the fields fresh green shoots were pushing themselves up alongside deep-olive beds of exquisite pale-blue iris lilies, and pink clumps of dwarf primulas and gay saxifrage which already begemmed the ground amongst the golden gorse bushes. From every hamlet the cottagers had swarmed out into their fields, and were busily ploughing and sowing in the glorious sunshine, forming pleasing bits of bright colour. The men were ploughing with oxen gaudily bedecked with plumes of wool, dyed glowing scarlet and blue, with long throat-tassels of dyed yak's-tails and harness of jingling bells, while close behind the ploughers came the gaily dressed women as the sowers, scattering broadcast the seed from their baskets. Most of them, men and women, were humming snatches of song in light-heartedness, or in pleasing vision of the new season's crops. Amongst the tall poplar trees embedding the homesteads, neatly picked out with red ochre and whitewash, and among the pollarded willow bushes fringing the irrigation canals, flitted rosefinches, fieldfares, hoopooes, pert tits, cinnamon sparrows, shy doves, warblers, and thrushes, all blithely pairing and nest-building; and beyond in the fields real English larks were singing skyward above the chirpy red-legged crows and foraging ravens. Occasionally flocks of sandgrouse sped swiftly past us, and a few wild duck and geese, scaring the partridge and hares from their cover, or the terns from their trout-fishing whirred noisily down amongst the reedy hummocks fringing the turquoise pools on the river where they breed."

With this idyllic picture may be coupled Mr. Landon's description of the approach to Lhasa. He writes—

"There was nothing, less, perhaps, in such maps and descriptions of Lhasa as we had than anywhere else, to promise us this city of gigantic palace and golden roof, these wild stretches of woodland, these acres of close-cropped grazing land and marshy grass, ringed and delimited by high trees or lazy streamlets of brown transparent water, over which the branches almost met. . . . Between and over

the glades and woodlands the city of Lhasa itself peeps, an adobe stretch of narrow streets and flat-topped houses, crowned here and there with a blaze of golden roofs or gilded cupolas. But there is no time to look at this: a man can have no eye for anything but the huge upstanding mass of the Potala palace to his left; it draws the eye of the mind like a lodestone, for, indeed, sheer bulk and magnificent audacity could do no more in architecture than they have done in this huge palace temple of the Grand Lama. Simplicity has wrought a marvel in stone 900 feet in length and towering 70 feet higher than the golden cross of St. Paul's Cathedral."

Both books are lavishly illustrated and supplied with valuable maps and plans. But it is obvious that colour is required to do full justice to Tibet, and Colonel Waddell's three-colour photographs and Mr. Landon's reproduced sketches make us somewhat discontented with the monotony of black-and-white plates, effective enough for buildings or figure-subjects, but too small to give the scale of Himalayan scenery.

Mr. Candler's volume is in the main a spirited narrative of the incidents of the march. By his own showing, the author was more interested in the human side of the adventure than in the "sights" of Lhasa. He has succeeded, however, in giving just the sort of information the average reader, who seeks for entertainment rather than instruction, asks for, the first-hand impressions of an eye-witness who, whenever his interest is roused and his intelligence excited, knows how to describe as well as to observe.

The fourth book, Mr. Millington's, is on a very small scale: his interests were mostly confined to the branch of the service, the transport, to which he belongs; and he has amused himself by adopting the camp slang and the traditional attitude of the British official towards general or scientific knowledge. Still, we thank him for a forcible summary of the advantages of Chumbi, some notes on the effects of altitude, and a graphic account of the mode of requisitioning provisions at a Tibetan monastery.

What are the chief additions to our geographical knowledge recorded in these volumes? In the first place, the route to Lhasa has been surveyed and mapped, together with much of the country along the frontier from Khambajong eastwards. Lhasa itself has been described, mapped, and illustrated, so that it is now as familiar as any European capital to the untravelled public. The popular conception of Tibet has been profoundly modified and corrected.

Readers of this journal will have been prepared to hear that it was not found to be the pathless and inhospitable frozen desert that had loomed in the vision of certain writers. But the descriptions, from which we have quoted, of the vale of Lhasa as an Arcadia, of its orchards and cornfields, its gardens and homelike wild flowers, as well as those of the city itself (Colonel Waddell goes so far as to style it "one of the most delightful residential places in the world"), will come on most of us as a surprise. The agricultural wealth of the country is considerable, and its pastoral resources seem to be large and capable of development. It should further be borne in mind that the still unexplored eastern Tibet, the valley of the Sangpo below the Choksam ferry, is reported to be a still more fertile and thickly inhabited region than that which charmed our soldiers. We have gained also full evidence as to the character of the valley of Chumbi, which has by accident become politically Tibetan while geographically and ethnologically appurtenant to the Cis-Himalayan states. On all the following points there is absolute agreement between our authors. Chumbi proves to be a Himalayan Oberland, the natural sanatorium for Calcutta and Bengal, standing to Darjiling in this respect in the relation the Engadine does to Monte Generoso. It has every qualification for a military station,

since it commands the main road to Tibet, and offers good camping-ground in a relatively dry climate, whereas troops at Darjiling are damped by excessive rains, and have to descend 6000 feet from their isolated hilltop in order to get anywhere. Chumbi is also obviously the natural site for our chief Tibetan trade mart. It seems hardly credible that the time will not soon come when it will be recognized that the only treaty which might have given the Tibetans a title to this valley never came into operation, and that there is no adequate political reason why it should not be made use of.

On a subject important to future explorers of the Himalaya—the effects of altitude on the human frame—a large amount of fresh experience has been collected. It all goes to confirm the experience of recent mountaineers, that the violent indisposition often felt on reaching heights of 12,000 to 15,000 feet tends to disappear on further advance after a short interval. It has been proved that at 20,000 feet many men can climb and carry burdens and even fight without serious suffering, though they will be handicapped by the altitude much as they would be at sea-level by a burden. It is, indeed, stated by Colonel Waddell that the Tibetans in their flight from the Karola crossed snowfields at a height of 23,000 feet. The incredulity that was freely expressed in India some twenty years ago as to the possibility of attaining such altitudes at all is now quite out of date. But the highest part of the battlefield being estimated at 19,000 feet, it is, to say the least, strange that fugitives should have climbed 4000 feet more, and it seems possible a three may have slipped into the place of a nought. The point is worth clearing up. The following observation of Colonel Waddell's is probably novel: "One curious result of the cold should be mentioned here, namely, its effect upon the speech of the people. A peculiarity of the language of the Tibetans, in common with the Russians and most arctic nations, is the remarkably few vowels in their words, and the extraordinary large number of consonants; for example, the Tibetan name for Sikhim is 'Hbrasljongs.' Indeed, so full of consonants are Tibetan words, that most of them could be articulated with almost semi-closed mouth, evidently from the enforced necessity to keep the lips closed as far as possible against the cutting cold when speaking."

To the remaining aftermath of the mission, the discoveries of the exploring party that has passed through Gartok to Simla, and the far more important expedition, postponed last year, but it may be hoped not indefinitely, to Eastern Tibet and the gorges of the Sangpo, we have, of course, only allusions in these works. But Colonel Waddell has been able to give, from native sources, some interesting information as to the latter district, and a Tibetan picture of the legendary falls of the Sangpo.

An appendix by Captain O'Connor to Mr. Landon's work, dealing with "the present condition and government of Tibet," is well worth perusal.

D. W. F.

AFRICA.

East Africa and its Animal Life.

'In Unknown Africa.' By Major P. H. G. Powell-Cotton. London: Hurst & Blackett. 1904. *Price* 21*s*.

'Mit Blitzlicht und Büchse.' By C. G. Schillings. Leipzig: R. Voigtländer. 1905.

Major Powell-Cotton has rendered signal services to the zoological collections of Great Britain, and to our knowledge of the life-habits and distribution of rare and interesting African mammals. It was he who obtained the first good specimens of the rare Abyssinian ibex for our national collections. He heard that the writer of this review had brought home from the country east of Mount Elgon three heads of the five-horned giraffe, and was anxious to proceed to those regions

of eastern equatorial Africa to substantiate this discovery, and, if possible, to procure complete specimens of this giraffine type. Difficulties of transport had prevented the present writer from bringing to London more than the heads and necks of three of the aforesaid giraffes, and, as one of these was a female without the extra pair of horns, naturalists were undecided as to whether the specimens constituted the type of a new variety or sub-species, or whether they were simply "sports."

Major Cotton amply confirmed this discovery, and the complete specimen of the five-horned or Baringo giraffe now in the Natural History Museum is due to his enterprise.

But the book under review is also the outcome of this expedition. It is a work which is more suited for review by the Zoological than by the Royal Geographical Society, since its main interest lies in its notes, photographs, and descriptions of the big game of eastern equatorial Africa, especially the region between Kilimanjaro on the south and the White Nile on the north, including the hitherto very little-known northern districts of the Uganda protectorate, north of Mount Elgon and west of Lake Rudolf. Yet from a geographical point of view also Major Powell-Cotton's journey is a remarkable one. He covered a little new ground north of the explorations made by Macdonald and Austin, and south and west of the journeys of Wellby and Donaldson-Smith. He has brought us back a good deal of information about that mountain of beautiful outline, Debasien, immediately to the north of Mount Elgon; and also concerning the western part of the Turkana country (with its mountains reaching to altitudes of over 10,000 feet), and the very little-known country of the Dodinga hills.

Major Cotton writes with some bitterness regarding the difficulties he met with on landing at Mombasa from the minor officials of the East Africa protectorate (in relation to the passing of his baggage, customs duties, etc.). He also is indignant at the want of encouragement given to him to obtain specimens of certain animals from the Reserves, and the slowness with which permission was granted to him to shoot animals placed on the "wholly protected" list. With regard to the first count of the indictment, there is no doubt that the complaint is well founded. Some special microbe must exist at Mombasa which makes the British officials there more unsympathetic and obstructive to the tourist than such persons generally are. Even the writer of this review, though himself an official at the time of his recent journeys in East Africa, had to complain of the delays which were placed in the way of passing his baggage through the customs house. But it is difficult to say whether either the Museum authorities in London, the Foreign Office, or the protectorate authorities in East Africa were to blame regarding the slowness with which the special permits were granted to Major Powell-Cotton. We all know him now, and the evidence of his discrimination as a naturalist and his remarkable public-spirited generosity may be seen by every one at the Natural History Museum, South Kensington. But when he was starting on his great journey through eastern equatorial Africa in 1902 his character and intentions were not so fully known as perhaps to warrant the authorities in according to him without hesitation the right to infringe the rules and regulations in force relative to the preservation of big game. It has grown to be the practice of every sportsman who wishes to visit the British protectorates in Eastern or Central Africa to ask for special facilities in regard to the killing of protected animals or shooting within game reserves. In nine cases out of ten this permission, if granted, is abused. The results are not beneficial to the national collections, while very harmful to the preservation of interesting wild animals. It is to be regretted, however, that in regard to Major Powell-Cotton's negatives and specimens

so much delay and petty annoyance should have been caused by the minor officials of the East African coast province.

The book contains many photographs of great interest illustrating the Nilotic negroes (Turkana, Dodinga, Tepeth, Lango, Karamojo, etc.), and a good deal of fresh light is thrown on the remarkable Elgon caves. The writer of this review adheres to his opinion that the original agent in the formation of the cave or hollow was water; but he has never denied—and certainly after Major Cotton's report would not wish to deny—that these caves have been enlarged, deepened, widened by the action of man.

There are some beautiful photographs of antelopes (notably one of an oryx), lion, hunting-dogs, and crowned cranes. Some of the pictures of cattle are interesting, as showing the distribution of certain breeds. Major Cotton, for example, is able to testify to the existence in Bukedi (far to the north-east of the Ankole plateau of western Uganda) of the long-horned, straight-backed cattle. The cattle of the Dodinga people and of most of the tribes he encountered seemed to belong to the humped, short-horned, zebu type. The long-horned, ordinarily straight-backed ox is at present one of the unsolved African problems. It is present in western and southern Nigeria, and in part of Somaliland. Major Powell-Cotton shows its existence, at any rate sporadically, in the Bukedi country to the north of Mount Elgon. It is the dominant breed in Western Uganda, and past the west coast of the Victoria Nyanza to the north-west coast of Tanganyika, wherever, in fact, the Hamitic aristocracy has penetrated. It can be traced westwards through the countries of the Dinka and Nuer to the eastern shores of Lake Chad. From Nigeria to the Gambia, it extends in a dwarfed form. It is apparently represented on the Egyptian monuments, on which it is given as straight-backed. At the present day this very long-horned type may be found in conjunction with a hump. No doubt this is due to intermixture with the more definitely Indian race which is so widely spread through Africa, and which differs from the long-horned type by its tendency to a blotched hide, and is known by that name of doubtful etymology—zebu.

Of course Major Cotton's book is interesting. It contains certain small inaccuracies of spelling, which might be remedied in another edition. The African sportsman several times referred to by the author is not Mr. Sidney Buxton, the ex-Under Secretary for the Colonies, but Mr. Edward North Buxton. In a good many cases the standard orthography of the Royal Geographical Society has not been adopted in the rendering of native names, and one is puzzled how to pronounce such spelling as "Pacey" (river). Amongst the appendices is a list of the native names for mammals in the Swahili, Masai, Suk, Dorobo, Nandi, and Turkana languages; but these again are somewhat spoilt by unscientific spelling, as, for example, where the Swahili *nyani* (baboon) is spelt *nearni*.

Herr Schillings's magnificent and hitherto unparalleled book is only marred by one feature, in that it is printed in that abominable German black letter, which a European congress should assemble to abolish for the general good of humanity. Fortunately for English readers, we understand that the book is to appear before long in an English translation, with of course a method of printing which will be less distracting to the impaired sight of the middle-aged and elderly. Like Major Powell-Cotton's book, the work of Herr Schillings would be more appropriately reviewed in the pages of the Zoological Society's Proceedings, since it deals principally with the life-history of beasts, birds, and reptiles. But it has a place in geographical literature, if only from its wonderful photographs of East African scenery—the peak of Kibo (Kilimanjaro); the Rufu river and its bordering

fringe of acacias or occasional patches of rich forest; the Masai steppes; the thorny bush; the scattered woodland through which the giraffes wander, halting at intervals to lose themselves to the eye of man amongst the tree-trunks and foliage; the roads, worn deep by the age-long migrations to and fro of elephants from feeding-ground to feeding-ground; the park.lands with their clumps of handsome trees, branching hyphæne palms and gouty baobabs; the lakes, the swamps, the ravines, the floods, the thorn-brakes, the sanseviera thickets, and the rare patches of luxuriant forest of eastern equatorial Africa.

Herr Schillings belongs to that new school of sportsmen whose founders have been Mr. Edward North Buxton and two or three Americans—men who have taught us that it is a finer sport, and one more productive of an increase to our knowledge (as a general rule), to follow up big game with the snapshot camera and the telephotographic lens rather than with the rifle. Our museums must, it is true, have their complement of specimens; but we hope that men like the author of this book will bring the world of fashion into the better path of not rushing out to Africa when they have lost money or made it, fallen in love or out, to recklessly slay all sorts of interesting creatures so that they may become possessed of trophies with which to adorn their homes in England, the said trophies often finding their way eventually to dust and moth and rats in attics and lumber-rooms. Herr Schillings's book is a triumph; it takes the first rank in sporting works of the new description. It contains the most marvellous pictures of animal life in Africa that have yet been secured by the camera, more wonderful even than the photographs of Lord Delamere or the exact and faithful drawings of Mr. J. G. Millais. So far as one can judge, the photographs reproduced in this book are absolutely "unfaked." There are wonderful pictures of giraffes wandering through the acacia woods, of elephants with enormous tusks passing through the long herbage on the slopes of hills, of flamingoes in full flight against an evening sky, cranes and egrets, marabou storks, secretary birds, and vultures; rhinoceroses under the shade of a canopied tree; great eland bulls hiding themselves amidst a tangle of grey lianas and thorn branches, or boldly standing out among the lush herbage in the open; lions rushing on their prey, hyænas snarling at jackals; leopards coming down to drink, zebras in herds of uncountable numbers; the beautiful Grant's gazelle, with its long and graceful horns, browsing on the short grass that heralds the African spring; kingfishers on sprays of grass, bustards preparing to rise into flight, ostriches searching restlessly with their keen sight for the suspected presence of man; wounded buffaloes, snorting gnus, fringe-eared oryxes, long-necked gerenuk gazelles (like some extinct mammal in weirdness of outline); colobus monkeys, baboons foraging for food; nearly every large and small bird and beast of the East African wilderness. Amongst the photographs is a very interesting snapshot of the rare striped hyæna of Eastern Africa which has been named after Schillings, its discoverer. Many of these photographs have been taken by flashlight at night at some drinking-place, or alongside the bait of some dead animal placed there to attract scavengers. The beasts that are thus photographed have evidently unconsciously pressed the light trigger of an apparatus, and are thus snapshotted before they have had time to pass from a natural attitude. Here is the life of the wilderness displayed in the full, as it has not too often been seen by the average traveller in East Africa. More than any book yet put before the public, it enables the stay-at-home reader to realize what wild beasts and birds look like in their own homes.

The letterpress is as interesting as the illustrations, but the book will gain enormously in popularity by its being translated into English and printed with a type less injurious to the eyesight than the German black letter.

H. H. J.

AMERICA.

A Text-book of the Geography of North America.

'North America.' By Israel C. Russell. (Regions of the World Series.) London: Henry Froude. 1904. *Price* 7*s*. 6*d*.

Coming from the pen of a well-known writer on physiographical subjects in a country where physiography has been recognized as a subject for special study, this volume may be expected to contain a clear, forcible, and well-balanced description of the physical features of the region of which it treats. In this expectation we are not disappointed. The early chapters on the coastal margin, the relief of the land, mountain ranges, climate, and vegetation are excellent. They are evidently the work of one who has travelled far and wide, and lived the nomad life of a field geologist on the western plains and in the sierras. Written in an easy style, always clear and sometimes eloquent, the account of the various subdivisions of the North American continent is not overburdened with technicalities, and holds the attention of the reader. Some parts of the subject, like the volcanoes, lakes, and river histories, are passed over somewhat lightly, no doubt because the author has already said what he has to say about them elsewhere; and, as the space allotted is small, while the area to be described is enormous, a selection of material has evidently been made according to its importance and the accuracy of the data available regarding it. Perhaps for this reason attention throughout is focussed on the United States and Alaska, while Canada and Mexico are regulated to the background. But, within its limits of space, this work contains the best general account of North American physiography with which we are acquainted.

The remaining chapters, however, are less successful. They treat of the animals, the geology, aborigines, political geography, and kindred subjects. American geologists have often declared that theirs is a typical continent, exhibiting in its structure and history the changes and development through which a great land-unit should pass. There is certainly room for a clear outline of the geology of North America suitable for educated readers who may be supposed to have no special knowledge of the subject. This the author has not even attempted to give, possibly because he considered it outside the scope of the volume, and the geological chapter is thin and flaccid. Even less satisfactory is the description of the natural resources of the country and the important part these have played in its development and the distribution of the population and industries; this part of the book is dangerously like a catalogue of the localities of useful minerals. The chapters on the aborigines and on the present political subdivisions are brief and sketchy compared with the full treatment accorded to historical and political geography in other volumes of this series. It is explained, however, that this is not altogether the fault of the author, as the fuller details on these subjects which he intended to give have been crowded out by lack of space. Undoubtedly the physical chapters, which have been retained, are by far the best in the book, and the only criticism that seems applicable is a regret that, in planning the volume, the scale of its parts has not been more carefully considered from the first.

J. S. F.

Geology of Alaska.

'Harriman Alaska Expedition: Alaska.' Vol. iv. Geology and Palæontology. New York: Doubleday, Page & Co. 1904.

Everything which can be done to make a book presentable by elegant printing, excellent paper, and abundant illustrations has been lavished on this volume. This, however, hardly redeems it from being a collection of casual scientific papers,

of very unequal interest. The best are those by Dall and Ulrich on the palæontological material collected by the expedition. Seven new genera and thirty-eight new species of invertebrates and plants are described and figured. Those from the Yukatat beds are specially interesting, and form a useful addition to the rapidly growing literature of Alaskan geology.

J. S. F.

The Geology of Para.

'Grundzüge der Geologie des unteren Amazonasgebietes.' By Friedrick Katzer. Leipzig: Max Weg. 1903.

A work of this kind, giving a general account of the geology and surface features of an area extending over hundreds of thousands of square miles, must of necessity be of the nature of an outline sketch. Much of the country is covered by swamp, jungle, and forest, and consists of the alluvia laid down by the great river and its tributaries. These gravels, sands, and clays are sometimes auriferous, and carry large numbers of irregular concretionary blocks, which led Agassiz to formulate his striking but erroneous theory of the glaciation of Brazil in recent geological times. Flat-topped, steep-sided hills of Tertiary beds rise above the level of the plains, and rest with a marked unconformability on Permo-Carboniferous, Devonian, and older strata. The author's account of the little-known Devonian rocks of the Amazon valley is of special value. They are often steeply inclined, and are penetrated by dykes and sheets of diabase. The Silurian is known only on the south side of the river. Metamorphic schists and gneisses of various kinds, representing an Archæan floor, emerge at various points and occupy an enormous area along the headwaters of the northern tributaries.

The physical history of the Amazon valley is in some ways very remarkable. The palæozoic strata of the region are marine, the Tertiary beds are fresh-water, and Mesozoic rocks are almost unrepresented. This is interpreted by the author to mean that continental conditions have prevailed since the Permian, and, if this be the case, the area is one of very great stability. The principal uplift has apparently taken place to the east, as the oldest rocks may be traced in a great crescent extending across the river's mouth and passing backwards on each side, while the latest deposits are laid down along the centre of the basin. During the Tertiary epoch great lakes and streams occupied the surface, and at first probably drained westward to the Pacific, but as the Cordillera slowly rose the drainage was obstructed, and finally the course of the river was reversed. This is a very curious hypothesis, and not entirely in accordance with the work of other investigators of Brazilian geology, but the evidence in favour of it is given with great clearness, and deserves careful consideration.

Dr. Katzer's work is certainly a concise and valuable compendium of the subject on which it treats, and will be welcomed by all who are interested in the geology of South America.

J. S. F.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

New Issue of Huxley's Physiography.

'Physiography.' By T. H. Huxley. Revised and partly rewritten by R. A. Gregory. London: Macmillan & Co. 1904.

Huxley's 'Physiography' is a work so well known and, in a sense, so unique that the attempt to bring out a revised edition of it is sure to be watched with interest. The editor has had a difficult task, and we have only praise for the

manner in which it has been accomplished. By carefully retaining as much of the old fabric as possible, and incorporating such additional material as was necessitated by the advance of science, it has been brought abreast of the times, while it still retains the old lucidity of treatment. Surprisingly little modification has been needed in most of the chapters, and the only vital alteration is that what was intended to be a study of the Thames basin, which should appeal mainly to youths living in London, has been given a wider scope and made more suitable for general readers. In this some loss of directness was inevitable, and the new material introduced—principally a chapter on geological structures and their meaning—is hardly up to the old standard. The work has been slightly abridged by the excision of the less important allusions in the original edition, but this seems to us a positive improvement. A large number of process blocks have been introduced into the text. They are admirably chosen, and, for the most part, successfully reproduced, and need only to be compared with the old woodcuts to show how great are the advances in cheap book-making within the last twenty-five years. Very wisely, no attempt has been made to conform strictly to current syllabuses. In its new form the book will interest a large public and have an extended lease of life.

J. S. F.

THE MONTHLY RECORD.

THE SOCIETY.

The Awards for 1905.—The Royal medals and other awards of the Society have been bestowed this year as follows: The Founder's Medal to Sir Martin Conway, for his explorations in various mountain regions and in Spitsbergen, prosecuted during a long series of years, and for the valuable contributions to geography resulting from those explorations in the form of papers, maps, and other publications; the Patron's Medal to Captain C. H. D. Ryder, R.E., for his survey of Yunnan carried out in 1899–1900 in association with Major H. R. Davies, and especially for the extensive and valuable work accomplished in connection with the recent Tibet Mission; the Victoria Research Medal to Mr. J. G. Bartholomew, for his long-continued services to British cartography, as shown particularly in the large atlases issued or planned by him, including the first volume of a great physical atlas, which will take a foremost place among works of its kind. Of the other awards, the Murchison Grant is given to Mr. William Wallace, C.M.G., for the great services rendered, directly or indirectly, to Geography during his service as an official in Northern Nigeria; the Gill Memorial to Colonel F. R. Maunsell, R.A., for his explorations in Asiatic Turkey, and for the large map he has compiled, largely from his own materials; the Cuthbert Peek Grant to Mr. Francis J. Lewis, for his valuable researches on the distribution of vegetation in the north of England, the results of which have been published in the *Journal*; and, lastly, the Back Grant to Captain Philip Maud, R.E., for his valuable survey work along the southern border of Abyssinia in 1903.

EUROPE.

Recent Movement of Elevation on the Irish Coast.—The subject of the oscillations of the relative level of the land and sea is receiving unusual attention at the present time, and the data available for the study of the subject are yearly becoming more extensive. Important researches into the most recent changes of level on the Irish coast have been lately made by Messrs. Coffey and Praeger, who have published the results of their examination of this region in the *Proceedings of the Royal Irish Academy* (December, 1904, vol. 25, Sect. C, pp. 143–200). The most striking of the features on the coasts of Antrim and Derry, which prove fluctuations to have taken place since the close of the Glacial period, is the well-marked shelf or terrace which is seen at various points; but the whole of the evidence is considered by the writers under the general headings of Phenomena of Erosion and Deposition. Of the former, the best-marked feature is the steep scarp at some distance from the present beach, and at some height above it, which marks the former encroachment of the waves. The scarp is frequently cut in the boulder-clay, but often, again, in much more ancient rocks. Between it and the present beach there is a level or slightly sloping plain representing the former beach or sea-bed. The deposits now laid bare by the uprise along this coast are extensive and varied, gravel and sand being found where the shores were open or where currents prevailed; mud where the waters were deeper or quieter. The character of the faunal remains furnishes valuable evidence as to the depth of the water and the conditions under which the organisms lived. The raised beach of Larne, a long tapering gravel bank heaped up by tides, is the best-known example of this category; but the finest deposits are the series of estuarine clays, etc., which can be studied particularly well at the new Alexandra Dock, Belfast. The post-Glacial geological history seems to have been as follows: In quite early times the land stood more than 30 feet higher than at present. Then followed a subsidence of not less than 55 feet, resulting in a land-level at least 25 feet lower than the present; for though no shelf has been found at a level corresponding with this depression, while the 10 to 15 feet shelf is on the other hand well marked, there seems no possibility of doubting the evidence of the deposits, and it is possible that an earlier beach has been cut away during the formation of a later one. A renewed movement of elevation probably raised the level about 5 feet higher than the existing one, a slight movement of submergence having brought about the existing conditions. These movements in the Belfast district are capable of close correlation with similar movements in the Mersey district, and in those of the Forth and Tay, the most distinctive character throughout the whole of this section of the British isles being the sharp Neolithic * uprise, which appears to die out rapidly both to the north and south. In the south, while a high land-level in early post-Glacial times, followed by submergence, is likewise traceable, the latter movement has been maintained, continuously or intermittently, down to recent times. It therefore appears that these recent slight fluctuations are of an uneven and local character, and no support is found for the view of Suess that it is the sea rather than the land-level which has shown a variation.

The Arctic Marine Fauna of Danish Lakes.—Dr. Wesenberg-Lund discusses in the *Geografisk Tidskrift*, Hefte 8, Bd. 17, the origin of certain forms in the Furesø. About forty-five years ago the Swedish naturalist, Sven Lovén, drew

* In the section of the paper devoted to archæology much care is taken to correlate the movements above described with early human periods.

attention to the Arctic relict fauna in the Swedish lakes, which he showed from geological data to have been an arm of the sea. Soon the number of so-called relict lakes was considerably increased, until at length all lakes received the name, in which forms originally marine were found to exist. In 1888 Credner protested against this view in his 'Reliktenseen,' pointing out that salt-water organisms can reach lakes through their drainage streams. Nor has the migration of these organisms been confined to the post-glacial period, as is proved in many parts of the world, especially in the case of the Jurassic marine fauna of Lake Tanganyika. There are also examples in quite recent times of the penetration of marine forms into lakes and rivers. In 1899 Dr. Lund discovered the form *Pallasiella quadrispinosa* and *Pontoporeia affinis* in the Furesø, and in 1902, *Mysis relicta*. The last has been studied by MM. Samter and Weltner in the lakes of North Germany. It makes for the lower colder depths in summer, being unable to bear a temperature above 57° Fahr., and it lays eggs only when the temperature is low. *Pontoporeia affinis* also retires to the deeper layers when the temperature rises, though it can bear a somewhat greater degree of heat; while *Pallasiella* propagates its species throughout the year, and bears a temperature which throws a doubt on its being a glacial form. Dr. Lund describes the Furesø, and decides that it was never reached by the sea. The time of its formation is unknown, but the whole neighbourhood shows signs of glaciation. The Arctic forms probably reached the lake when the oak was the prevailing tree, when the sea was only two-thirds of a mile distant on the east, and at least 7 miles on the west. Probably when the salt water penetrated into the *Ancyclus* lake, the fauna took refuge in the mouths of the rivers, and ultimately reached the lakes, and among other forms would be those of Arctic origin which had adapted themselves to the fresh water of the *Ancyclus* lake.

ASIA.

Lieut. Filchner's Expedition in Eastern Tibet.—Lieut. Filchner is a young German officer who some years ago set himself the task of exploring some of the still unknown regions of inner Asia. As a preliminary attempt he made a journey in the Pamirs, which he described in a narrative published two years ago. He has since made a more extended journey, this time in what is probably one of the least-known districts on the borders of China and Tibet—that stretching south-east from the upper Hwang-ho to the western frontier of Suchuan.* Lieut. Filchner (who belongs to the Bavarian army) is on his way home through America, but some account of the journey has already been given (from letters sent home by his companion, Dr. Tafel) in the *Zeitschrift* of the Berlin Geographical Society (1905, No. 3). Dr. Tafel being a geologist, his report throws a valuable light on the physical configuration of the region traversed. The explorers made their way first from Shanghai *viâ* Singan-fu to Sining, on the borders of the Koko-nor province, Lieut. Filchner being accompanied thus far by his wife. It was their intention, if possible, to follow the course of the Hwang-ho through the great bends which, according to Chinese maps, it makes during the interval between its exit from the Oring-nor and the point where it was crossed by Drs. Holderer and Futterer; and though this could not be carried out in its entirety, a considerable stretch of the river's course was examined. The start from Sining was made on June 24, 1904, and on July 20 the Hwang-ho was reached at the spot where it was crossed by Grenard. The stream was, however, in flood, and it was necessary to

* A part of this region was traversed by Mr. Birch and Captain Watts-Jones in 1900, but, as the expedition ended fatally for both travellers, no precise details as to their route are available (cf. *Journal*, vol. 21, p. 651).

ascend almost to the Oring-nor before it could be crossed. The travellers then went south to Lake Kala-namtso and followed down the winding course of the Richu to its confluence with the main river, continuing east and east-south-east along the latter until its great bend to the northward, when the perpendicular cliffs of sandstone made it impossible to follow it further. The trade-route to Sungpan on the headwaters of the Min (visited by Gill and various travellers from the south) was then struck, and led over an elevated region with snowy passes,* the chief difficulties arising, however, from the inhabitants, who on October 1 made an organized attack on the party and plundered them of all their baggage. The remainder of the way to Sungpan was therefore accomplished amid great difficulties and hardships, the return to Sining being by way of Lan-chau. Dr. Tafel gives interesting notes on the geology and physical geography of the region of the upper Hwang-ho. North of the river various chains of mountains were crossed, some consisting of limestone and schists, some of granite, these last being apparently the snowy ranges of Prjevalski. They are, however, not so important as they have been shown on the map. In the neighbourhood of Tossun- (Tosso-) nor, chains composed of coral-limestone with great numbers of fossils occur, and south of the lake a vast area composed of hard green, blueish, or grey sandstone, traversed by quartz veins, extends almost to Sungpan. The Amne-machin range is composed of this, and the whole upper course of the Hwang-ho with its lakes lies in the same formation, which alternates with black clay-slate, and has a strike parallel to the direction of the river. After having been cleared by its passage through the Oring-nor, the Hwang-ho becomes turbid for a time on account of a red clay which occurs near it; but as its tributaries, which almost all flow in from the south, have clear water, it becomes clearer once more. In one section it passes through a remarkable series of sand-dunes and barkhanes. The side valleys all join it at a sharp angle, which causes the water to be impounded in a series of lakes. Their general direction (which corresponds with that of the quartz dykes) was N. 10° E., which seems due to an extensive series of fractures. Glacial traces were more than once observed, and the Kala-namtso lake is a shallow moraines-girt basin, contrasting strongly with the rock-bound Oring-nor. North of the Amne-machin range the valleys are wide and steppe-like, while to the south their floors are filled with pools and morasses. An abnormal amount of rain seemed to have fallen last year throughout the whole region.

Lake Exploration in Asiatic Russia.—The Russian geographers take a considerable interest in limnology, and we find in the last number of the Moscow periodical *Zemlevyedenie* (1904, 1 and 2) several papers devoted to this subject. L. Berg gives a very good monograph of Lake Issyk-Kul, with a map and a few photographs. According to the last geometrical measurements the altitude of the lake is 5165 feet, and its depth reaches about 425 metres (1400 feet) in its deepest portion, 33 miles from the southern coast. It is interesting to note that a uniform depth of 256 metres (840 feet) prevails in the middle portions of the lake, thus reminding one of the "plaine centrale" of the Lake of Geneva. The depth decreases towards the east, but even there depths of from 57 to 70 metres (185 to 230 feet) are found. It is well known that the river Chu, after having approached very closely to the lake, suddenly turns northward and pierces a lofty mountain range. We have thus in lake Issyk-kul and the Chu the very same phenomenon as in the Lake of Geneva and the Arve, in Lake Baikal and the Irkut, Lake Ulungur

* Mr. Birch crossed two passes at a height of nearly 14,000 feet, probably somewhat further east. He had no difficulty with the Mantse tribes encountered on his route.

and the Black Irtysh, Lake Bagrach-kul and the rivers Haidyk-gol and Konche-Daria, and many other lakes of Asia. In all these cases, we have not merely instances of rivers which have filled up their beds with their own deposits, but also of a sinking of the level of the lakes during a recent geological period. Berg indicates further on that the Issyk-Kul has probably its *seiches*, which are evidently increased in the event of earthquakes. A considerable amount of attention is also given to the changes of level in the lake; and it may be taken as certain that during the years 1859 to 1897 the level of the lake was sinking, for all available testimony agrees in this respect; but it is also not less certain that since the year 1900 a rising of level has taken place. It seems, also, doubtless that this rise is caused by a temporary increase in the precipitation. Thus the average precipitation at Prjevalsk was 385 millimetres during the years 1891–1895, and 554 millimetres during the three years 1896, 1901, and 1902. The same increase is seen at Vyernyi, where the precipitation was—

1881–1890	550 millimetres.
1891–1900	592 „
1901	815 „
1902	809 „

A considerable increase in the quantity of water discharged by the Chu has also been noticed. As to previous geological periods, it is certain that the lake once stood several hundred feet higher than it stands now; but this must have been at the time when the glaciers of the Tian Shan had a much greater development than the present one. Berg also passes in review the geology of the surrounding mountains, and shows that they contain no traces of *marine* deposits younger than Devonian and Carboniferous, and that the so-called Hanhai deposits are not of marine origin, but aërial. He also speaks of the effects of earthquakes resulting in local subsidences, and concludes his very valuable monograph by a sketch of the climate of the region. Another interesting paper deals with the exploration of the "Lakes of the Kokchetav district of the Akmolinsk province," by P. Ignatov. These lakes have been rapidly drying up since the beginning of the nineteenth century. All this part of the Kirghiz steppe is dotted with such lakes, all of which have but a small depth. Two more papers deal respectively with one of the lakes of the Senno district of Moghileff and the lakes of the government of Vitebsk. All are accompanied by bathymetric maps and some photographs.

Expedition to the Khatanga River, Northern Siberia.—We learn from the *Geographische Zeitschrift* (1905, No. 2) that a scientific expedition has been organized in Russia for the exploration of the Khatanga river in northern Siberia. The scientific staff consists of J. Tolmacheff, curator of the geological museum of the academy; Mr. Backlund, astronomer; and Mr. Koshevnikoff, topographer. The programme includes (besides geological researches) the survey of Lake Yessei, the position of which is not yet accurately fixed; a visit to Lake Monero; and a search for the lake Voievoli, reported by the Tunguses. It is hoped, also, to ascend the Khatanga in boats, and to examine the mouth of the Monero river. The expedition is due to the initiative of the academician F. Schmidt, who has contributed eight thousand roubles to the expenses, the remainder being borne by the Imperial Russian Geographical Society.

AFRICA.

The Segonzac Expedition in Morocco.—The Marquis de Segonzac, whose excellent geographical work during his first expedition in Morocco is known to readers of the *Journal*, last year undertook a new expedition, which has resulted in valuable additions to our knowledge, although the detection of the leader's

disguise as a Mohammedan has unfortunately led to his imprisonment by the Berber tribe of Seketanas. A short account of the expedition from its commencement is given in the supplement to the *Tour du Monde* for April 1. The explorer was accompanied by M. Gentil, as geologist; M. de Flotte Roquevaire, well known for his previous contributions to the mapping of Morocco; with a Berber and an Arab interpreter. Arriving at Mogador, the travellers found it necessary to separate, so as better to escape suspicion, M. Gentil undertaking the geological examination of the country bordering on the south-west extremity of the Atlas, M. de Flotte the triangulation of the region between Mogador and Marakesh, while M. de Segonzac took in hand the exploration of the Great Atlas and its southern border. The journeys of the last named are of special interest. From Marakesh he followed the northern foot of the Atlas by Sikahal and Demnat, afterwards penetrating into the interior of the range by the valley of the Wed El Abid, a southern tributary of the Um-er-Rebia. From this he crossed by a comparatively easy pass (which offers facilities of communication between the two versants similar to those afforded by the Teza gap in the north) to the upper Muluya valley, there effecting a junction with his surveys of 1901. This river was found to have its source further to the west than had been supposed. M. de Segonzac then crossed the great Atlas, in the neighbourhood of Mount Aiashi, and made his way to Tafilet by the valley of the Wed Gheris. It was during the further journey towards the coast of the Atlantic, still on the southern side of the Atlas, that the traveller was made prisoner. In this region of hereditary sheikhs and small Berber settlements the sultan's influence is but small, and the release of the prisoner will probably depend on the payment of a ransom. Besides studying the political and ethnographical relations of the regions visited, the traveller had collected a considerable number of fossils and other geological specimens.

The Upper Valley of the Dra, Morocco.—In spite of recent exploring activity in Morocco, there still remain wide districts on which our information is very scanty, and among these is the valley on the upper Dra, on the south side of the Atlas, to which only a few Europeans, such as Caillié and De Foucauld, have yet penetrated. Some information on a portion of this region has been collected by Captain Regnault (*Renseign. Coloniales, Comité de l'Afrique Française*, No. 1, 1905), who, without himself visiting it, has made careful inquiries from an intelligent and travelled native, Lhassen ben Aissa by name, whose home is at Tiraf, in El Ktaua, the district in which the Dra reaches the most easterly extension of its course.* In questioning his informant, Captain Regnault had recourse to a species of object-lesson, the district to be studied being outlined on a piece of sandy ground, on which the relative bearings of the principal localities were laid down, and the distances between them estimated. The result is shown on a sketch-map accompanying the paper. The districts on the section of the Dra in question are, from below upwards, Mhamid, El Ktaua (pronounced Lektaua), Fezuata, Ternata, and Tinzulin. Throughout these the Dra is a permanent stream 30 to 40 yards wide at ordinary times, with a depth of 2 or 3 feet. In time of flood the width becomes half a mile and more, and the stream sometimes invades the palm groves and washes the walls of the "ksur." The region is generally rich, and irrigation of the palm groves and cultivated lands is carried out by means of canals which sometimes serve two or three "ksur" at once. Below Mhamid the river-bed is dry except at unusually high floods. The valley is flanked by hills 150 to

* Information was collected in a similar way some years ago by the Comte H. de Castries, whose "Notice sur la région de l'oued Dra" (*Bul. Paris Geog. Soc.*, 1880) has been one of the best authorities on this region.

300 feet in height, which now recede, forming wide basins, and again close in to form narrow passes. One of these, south of Ternata, is less than 1000 yards wide (600 to 800 metres). The paper contains details as to productions, industries (chiefly the weaving of fabrics and tanning of goatskins), commerce, administration of justice, and so forth.

Mr. Cunnington's Zoological Researches on Lake Tanganyika.—Mr. Cunnington, who was last year sent out by the committee for the scientific exploration of Lake Tanganyika to carry on the investigations begun by Mr. J. E. S. Moore, has lately sent home a report of his experiences down to October 29, 1904. On his way up Lake Nyasa he had obtained good collections of the minute fauna and flora characteristic of the lake's surface. The temperature of the surface water was found to rarely fall below 70°, while at 76 fathoms below the surface it was found to be about 3° higher. On Tanganyika he obtained a dhow in which to move about at will from one part to another, and he had already made a good collection of fishes, besides many freshwater crustaceans. The vegetable life seemed to present marked resemblances with that of Nyasa.

Dr. Uhlig's Latest Expedition in East Africa.—We have more than once alluded to Dr. Uhlig's fruitful researches in East Africa, both in the region of Mounts Kilmanjaro and Meru and on the Victoria Nyanza. His latest journey, which was begun in July, 1904, in company with Dr. F. Jaeger and Herr Gunzert, led again to the neighbourhood of the two great mountains, but was continued beyond Meru to the region of the Natron lake in the southern portion of the rift-valley (*Zeitschrift*, Berlin Geographical Society, 1905, Nos. 2 and 3). As already recorded in the *Journal*, Dr. Uhlig made a second ascent to the Kibo crater of Kilimanjaro, and discovered that the glaciers had diminished sensibly since his visit in 1901. The journey from Meru to the rift-valley led over the almost waterless steppe by a route that had not previously been surveyed. Early in September the still active volcano of Oldonyo l'Engai (Donyo Ngai) was ascended, Herr Gunzert reaching the actual summit (about 9200 feet above the sea), while on account of the heat and want of water his companions were forced to stop at some 800 feet lower. The sulphurous exhalations from the crater were perceptible to the smell over 1500 feet below the summit. It is a cone of tuff rising 6500 feet above the plain, and apparently resting on lava of not much greater age. Among the volcanic phenomena of the steppe is a series of small lakes ("Maare"), the sides of which sink so suddenly in the level plain that they often cannot be seen until closely approached. From the south-west shore of the "Magad" or Natron lake, the travellers ascended the side of the rift-valley, and made their way to Sonyo and Engurman (Nguruman), noticing the extraordinarily complicated structure of the western wall of the valley. The old volcano of Sambu (7879 feet) was climbed, and afforded a splendid view over the Natron lake. The volcano has been cut in half by the second great dislocation, and this has also been the fate of several other volcanoes to the west of Donyo Ngai, which have not been marked on the maps. The largest of them, called the Masai Elanairobi, was ascended. Its height of 12000 feet makes it the highest summit to the west of the rift-valley. After various other investigations a return was made to Meru, which was once more ascended, and steam was found to issue from the innermost cone of ashes within the crater. The volcano may therefore be classed as active. Besides the surveys and geological researches, a collection of over 500 plants was made and 450 photographs were taken. Dr. Uhlig also paid attention to the advantages offered by this region for settlement by Boers, and came to the conclusion that the grassy steppes west of the rift-valley are well suited for the purpose.

New Districts in British East Africa.—By a proclamation dated February 11,

1905, the Masailand district of the Ukamba province has been divided into two separate parts, viz. the Kikuyu and South Masai districts, the headquarters being for the present respectively Dagoretti and Nairobi. The precise limits of the districts are defined in the *Official Gazette for East Africa and Uganda* of March 1.

The Germans in the Shari Basin.—An interesting journey on the Logone, the great tributary of the Shari, has lately been made by Captain Stieber, Resident for the German Chad territories, from his headquarters at Kusseri (*Deutsche Kolonialzeitung*, No. 8, 1905). It was undertaken mainly with a view to strengthening German influence in the Shari basin, but the leader's notes on the present condition of the Musgu country through which he passed contain much new information. In particular he gives a striking account of the density of population, the route passing for days and weeks through a succession of houses, farms, and cultivated fields. Further south, as the French boundary was approached, the density became somewhat less, though still considerable. The expedition succeeded in opening friendly relations with the natives, who were glad to be assured of protection against attacks from the side of Bagirmi. Near the boundary relations were entered into with the French officials, and a provisional frontier agreed upon, though when the surveys of various travellers in this region have been worked out it is probable that it will have to be shifted to the advantage of Germany. The return journey was made by a more easterly route, which followed the Ba-Ili for some distance. This stream was over 75 yards wide where crossed, but had no current, and in the dry season dries up almost entirely. It forms the eastern limit of the Musgu country. Captain Stieber does not share Captain Lenfant's sanguine expectations as to the value of the waterway between the Benue and Shari, owing to its shallowness and the fact that it is open for a few months in each year only. He thinks, however, that it is not impossible that a better channel than that followed by Lenfant may exist.

Southern Nigeria.—The Colonial Office Report on Southern Nigeria for 1903, No. 433, records a less heavy rainfall than in 1902. The mean rainfall for the five meteorological stations was 104·94 inches. At Old Calabar the rainfall was 141 inches, the wettest month, July, with 34 inches, being thirty-seven times wetter than the driest month, March, and twenty-three times wetter than the next driest month, January. Twenty-five rivers and creeks have been cleared of obstructions and charted during the year. From a coast-line 300 miles long, the area extending for 50 miles inland is all a network of waterways, and main rivers connected by creeks run out to sea by mangrove-fringed courses. Hence the necessity of having them cleared for launch and canoe traffic. To the staple products, palm oil and palm kernels, some few others may now be added. Thus the area of rubber plantations has been extended, and a few chiefs have been induced to begin operations. The native obstinacy in refusing work not promising an immediate return is, however, a standing drawback to the rubber, caco, and coffee industries. The timber trade, non-existent a few years ago, exported in 1903 460,446 superficial feet (valued at £32,027), or treble the export of 1902. The tonnage of British shipping shows an increase of 23·2 per cent., and foreign shipping of 32·7 per cent. over 1902. More than a quarter of the protectorate is not yet under control.

AMERICA.

Exploration in Dutch Guiana.—A full account of the Saramacca river expedition, by Lieut. A. J. van Stockum, appeared in the *Tijdschrift* of the Dutch Geographical Society, 1904. As reported in vol. 22, p. 217, the river was traced to the

Zuidheuvel, now called the De Kock mountain. On the eastern side the Van Asch van Wyck range runs north-north-east. One of the higher peaks, the Ebba-top, 2560 feet high, in lat. 4° 20′ N., was ascended, and an excursion was made to the Hendrik-top, in the Emma range (vol. 20, p. 636). A map accompanies Lieut. van Stockum's article, and a report on the rock specimens by Heer C. Moerman. Another expedition, under the leadership of Lieut. A. F. Herderschee, spent the autumn of 1903 on the upper Marowijne or Lawa, and explored the Goninie, which lies between the Lawa and the Tapanahoni, and is formed by two streams, the Emma and Wilhelmina, descending from the Orange hills, 1200 to 1500 feet high. Then the Litanie, the western head-stream of the Lawa, was ascended to the Tumuc-Humac mountains, which here run from south-east to north-west with a height of 2300 to 2600 feet. The country was carefully mapped, the survey of the boundary commission of 1861 being completed as regards the Lawa, meteorological and magnetic observations were taken, and rock specimens and ethnological objects collected. Last autumn Lieut. Herderschee returned to Paramaribo, in order to complete the exploration of the Tapanahoni, the lower section of which he had visited on the former expedition. From a granite top 650 feet high, the Orange mountains were seen to bend south-westwards to a mountain 3900 feet high, the Kassikassi-ma, which subsequently proved to be inaccessible. The Palume was ascended as far as 2° 50′ N. lat., and one of the party, Heer Goeje, proceeded further up the river to look for the Trio Indians, who are almost unknown to Europeans. They have only one village at the sources of the Palume, most of them dwelling on the upper Paru, beyond the Tumuc-Humac range. The Indians on the Tapanahoni have no knowledge of the upper Suriname and Corentyn, though they are well acquainted with the Yari and Paru (*Tijdschrift*, 22, No. 1).

Voyage of the "Neptune" to Hudson Bay and Baffin Bay.—The *Neptune*, which sailed in the summer of 1903 on behalf of the Canadian Government to the northern waters of the Dominion, with a view to more firmly establishing Canadian authority in those regions, returned to Halifax in October of last year, after accomplishing some useful work. Mr. A. P. Low, the well-known geologist and explorer, went with the expedition, and we learn from *Petermanns Mitteilungen* (1905, p. 72) that he has made a preliminary report on the expedition in the thirty-seventh annual report of the department of Marine and Fisheries, which we have not, however, yet received. The surveys carried out by the expedition will, it seems, considerably improve the basis for the mapping of these regions, the coast of Hudson bay between Chesterfield inlet and Wager bay having, in particular, been examined during a winter sledge expedition.

Navigation of the Uruguay.—A report issued by the Argentine Ministry of Public Works, as an accompaniment to the Argentine hydraulic exhibits at the late St. Louis Exhibition of the United States, sets forth the progress made by the commission charged with the survey of the Uruguay river between River Plate and Concordia with a view to its improved navigation. The survey between Concordia and Concepción del Uruguay has been completed. Observations made at the different tide-gauges set up by the commission in the river have not only established the fact, formerly suspected, that some tides reach up to Concepción, but have determined the law of their occurrence and their amplitude. Apart from wind, ordinary tides, due simply to lunar attraction, extend 182 miles up to Nueva Palmira, where they attain 6 to 10 centimetres in height. Extraordinary tides, on the other hand, under the influence of winds of the second and third quadrant, travel up to Concordia, reaching there a height of over 1 metre. This is itself a proof of the very gentle fall of the Uruguay. The mean fall of the river at ordinary high water is 0·06 metre per kilometre between Concordia and Nueva

Escocia, and 0·015 metre between Banco Grande and Fray Bentos. The ocean navigation of the Uruguay extends to below San Francisco bar; the coast navigation up the river to Concordia. The former is effected by vessels of 700 to 1000 tons, drawing up to 18 feet; the latter by river steamers carrying 300 passengers and 550 tons of cargo and drawing 9 feet, by towed lighters of 300 to 600 tons; and by small coasters carrying 30 to 100 tons and drawing 5 to 8 feet. At several ports on creeks the cargo has to be transhipped into smaller steamers. The yearly traffic in the Argentine ports of the Uruguay is about 350,000 tons, a volume which would, with improved navigation, be increased, as many cargoes now going direct by rail from Montevideo, etc., would then return to the use of the river route. The report gives a detailed description of the lower and middle Uruguay, and a brief account of the works carried out in 1902 and 1903.

AUSTRALASIA AND PACIFIC.

The "Albatross" Expedition to the Eastern Pacific.—The extract from a letter from Prof. A. Agassiz, giving details as to the work of the *Albatross* expedition down to November 28, 1904, is printed in the *American Journal of Science* for February, 1905. The expedition left San Francisco on October 6, and during the voyage to Panama made collections of pelagic material, both from the surface and to a depth of 300 fathoms. Off Mariato point two hauls were made in the vicinity of the stations which in 1891 yielded "modern green sand," the specimens of which were then, however, unfortunately lost, so that the rediscovery of the same sand on the recent voyage is of much interest. After visiting Panama and returning to Mariato point, a line of soundings was made toward Chatham island, in the Galapagos, the deepest point (1900 fathoms) occurring about 100 miles south-west of Mariato point. Beyond this about 1700 fathoms was shown for nearly 200 miles, the bottom then shoaling gradually to 1418 at about 80 miles from Chatham island, and then sloping quite rapidly for the remainder of the distance. Other lines were also made, including one from Aguja point first south-west, and afterwards east to Callao; a depth of over 320 fathoms being found in the Milne-Edwards deep about 80 miles off that port. Prof. Agassiz gives some notes on the pelagic collections, which on the whole were remarkably rich. They are remarkable for the variety and number of pelagic fishes which, though many of them had been considered as true deep-sea fishes, were obtained inside the 300-fathom line at a considerable distance from shore. The number of diatoms found in this tropical region was also interesting from the fact that they have usually been considered characteristic of more temperate and colder regions. The great variety of organisms contained in the hauls, even on successive days, showed the impossibility of making at sea a quantitative analysis of the pelagic fauna and flora at any one station within the influence of such a great oceanic current as the Chile and Peruvian stream.

POLAR REGIONS.

The Peary Arctic Expedition.—The vessel in which Commander Peary's new expedition is to make its way north in July next (see March *Journal*, p. 332) was launched at Bucksport, Maine, on March 23. On the following day the *Roosevelt*, as the ship has been christened, was towed to Portland, where she is now being fortified to withstand the pressure of the Greenland ice, and where she is being fitted with engines which will develop from 1000 to 1500 horse-power. In technical phraseology, "a three-masted fore-and-aft schooner-rigged steamship with auxiliary sail power," the *Roosevelt* is described as similar in general design to the modern steam-whaler, though with rather sharper lines. Her sides and bows, however, have been specially rounded, so that she may be able, if squeezed by the ice, to lift herself free. The *New York World*, from which these particulars are

taken, reports the principal dimensions of the vessel as—length over all, 182 feet; beam, 35·5 feet, depth, 16·3 feet; mean draught, with stores, 17 feet; gross tonnage, 614 tons; estimated displacement, about 1500 tons. White oak has been used in her construction; treble frames and double planking give her walls a thickness of from 2 to 2½ feet; 12 feet of solid dead wood strengthen the bow, while false keels and keelsons, 6 feet deep, run along the entire length of the ship. At the luncheon which followed the launching of the *Roosevelt*, Commander Peary announced that in all probability the commander of the vessel would be Captain Bartlett, who, it may be remembered, served the explorer in a like capacity throughout his last great expedition. A base camp will be established, and in the spring of next year the persistent explorer, supported by a company of picked Eskimo with dogs and sledges, will make a great effort to reach the pole. He hopes to return to New York in the autumn of the same year.

Captain Amundsen's Expedition to the North Magnetic Pole.—A record left by Captain Amundsen on Beechey island (south-west corner of North Devon) in August, 1903, and found there last summer by the *Neptune*, shows that good progress had been made down to that date, little or no ice having been encountered during the passage through Lancaster sound. The expedition had carried out some magnetic and geological work, and was about to start onwards through Peel sound. The depôt established by the British Government on Beechey island had been entirely destroyed, though the Franklin monument was intact.

The Ziegler Arctic Expedition.—A fresh relief expedition is to be sent out this summer to attempt communication with Mr. Fiala, who went north by the Franz Josef Land route in the summer of 1903, and has not since been heard of. The *Terra Nova*, the second relief ship of the British Antarctic Expedition, has been bought for the purpose.

Ellesmere Island.—This designation has now been adopted by the Geographic Board of Canada for the insular mass to the west of Smith sound, in deference to the suggestion made last year in the *Journal* (vol. 24, p. 230). The name previously assigned was "Ellesmere Land."

Glaciers in Greenland.—Dr. Engell was sent out in the summer of 1902 by the commission for geological and geographical investigations in Greenland to examine the glaciers in the neighbourhood of Jakobshavn. This is the largest colony in north Greenland, and has a very productive fishery, but yet the houses are among the most wretched in the country. The Jakobshavn glacier has retreated considerably since 1850, and a contraction is perceptible in a vertical direction. The level of the water in the two lakes beside it, the Nunatap Tasia, was found to have fallen 118 feet in the western and 92 in the eastern basin below the highest level it had formerly attained. Blocks sometimes fell from the face of the glacier, but there was no proper calving. The movement of the glacier was about the same as Hammer found it to be in 1880. Lieut. Schjørring made a triangulation of the environs, setting up marks for future use. The glacier in the Sikuijuitsok fjord has also retired a long distance since 1880. Dr. Engell also surveyed the mountain Akugdlinguak, 1837 feet high, and adjacent heights on the Orpiksuit fjord near Kristianshaab, and examined the inland ice behind them. In the same number of the *Meddelelser om Grønland* (Hefte 22), Dr. Schultz-Lorentzen compares the dialects, customs, implements, etc., of the Eskimo of east and west Greenland, and from the greater similarity between those of the east Greenlanders and the Eskimo of the west coast south of Godthaab, arrives at the conclusion that the latter are the vanguard of a migration down the east coast. The same subject has been discussed by Prof. Faustini (see vol. 23, p. 392), who did not, however, clearly mark the meeting-place of the eastern and western migratory streams.

Results of National Antarctic Exploration: Erratum.—April *Journal*, p. 374, line 27, for "Derville" read "d'Urville."

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Motion of Glaciers.—In a paper entitled "A Contribution to the Theory of Glacial Motion" (University of Chicago: Decennial Publications), Prof. Chamberlin gives a concise summary of his views on the cause of glacial movement. Incidentally, he discusses the method by which snow passes into coarsely granular glacier-ice, the distribution of temperature in glaciers, and the effects of differential movement and shearing. He points out that in a moving glacier there are two apparently discordant phenomena to be explained: the glacier moves like a plastic mass, with a higher velocity at its centre than towards its edges, and adapting itself more or less perfectly to the shape of the channel in which it flows; at the same time it has many properties implying considerable rigidity under thrust, can hold stones embedded in its base so firmly that they groove and tear out solid rock, and can be forced forward by pressure from behind even against a considerable slope. The conclusion arrived at is that even where a glacier is coldest, dryest, and most rigid, the impelling power of its own weight can cause it to move forward by means of small displacements of the component granular ice-crystals on one another. The crystalline gliding-planes are not supposed to be of importance except locally, but movement is facilitated by temporary liquefaction of the glacier grains at their surfaces, where the pressure is greatest, followed by freezing as soon as the pressure is relieved. The explanation favoured is consequently a modification of the "viscous" theory, combined with those of regelation and crystalline deformation.

GENERAL.

Geography in the University of Edinburgh.—A laudable effort is being made in Edinburgh for the endowment of a chair of geography at the university of that city. A step towards the further recognition of geography as a subject of study has been taken by the Senatus of the university, which has decided to admit the subject as one qualifying for graduation in the Faculties of Science and Arts. A proposal for the establishment of a chair in geography has met with official approval, which has also been expressed by the councils of the Royal Scottish Geographical Society, the Royal Society of Edinburgh, and the Edinburgh Merchant Company. As a practical step towards the end in view, a committee has been formed for the purpose of raising the necessary funds, which are estimated at £15,000. The chairman is Dr. James Geikie, and the secretary Mr. J. G. Bartholomew, to whom subscriptions to the fund may be sent.

OBITUARY.

Adolph Bastian.

By the death of Prof. Adolph Bastian at Port of Spain, Trinidad, on February 3, 1905, ethnology loses one of its most illustrious exponents. Throughout the second half of the nineteenth century the name of the "Old Master," as his German colleagues were fond of calling him, has largly dominated this branch of science, to the advancement of which his whole life was earnestly and unselfishly devoted. Son of a prosperous Bremen trader, he was born in that busy seaport on June 26, 1826, and there, perhaps, acquired that restless enterprising spirit which

later carried him to the ends of the Earth in the exclusive interests of the one object which entirely absorbed his prodigious physical and mental energies. After studying law at Heidelberg, and the biological sciences at Berlin, Jena, and Würzburg, he took the degree of M.D. at Prague in 1850, and the very next year set out on that long series of ethnological expeditions, which jointly occupied no less than twenty-five years of a singularly active career, and would justify his claim to be regarded as the greatest of collectors and of travellers, if his modest and retiring nature could have induced him ever to have claimed anything for himself personally. But the remark made by Dr. Karl von den Steinen, one of the speakers at the "Gedächtnisfeier," held in Berlin on March 11, that no German savant has travelled, read, or written more than Bastian, will pass unquestioned by those acquainted with his life-work in all its fulness.

The first journey, which lasted eight years (1851–59), took him to Australia, Peru, the West Indies, Mexico, China, Malaysia, Indo-China, India, Angola, and other parts of West Africa, and the special bent of his mind for the psychological side of his subject was at once revealed in the sub-title ('A Contribution to Mythology and Psychology') of his first publication ('A Visit to San Salvador,' 1859), which embodied some of the fruits of the expedition. The influence of the views here advocated was almost instantaneous, as shown by the rapid appearance of the great works of Th. Waitz and E. B. Tylor on the origin and development of primitive cultures.

Then followed the second expedition (1861–65), which brought him again to Indo-China, and thence through Malaysia and the Philippines to Japan, North China, Siberia, and Caucasia, resulting in 'The Peoples of Eastern Asia,' a work in six volumes indispensable to students of Buddhism. A third trip to Loango (1873), undertaken for the purpose of opening up the Dark Continent from the west side, proved a failure, but prepared the way for the subsequent expeditions, all of which were henceforth carried out in the direct interest of the Berlin Ethnological Museum, of which Bastian was the real founder and for many years curator. The fourth (1875–76), directed to South and Central America (Ecuador, Colombia, Peru, Guatemala, and the West Indies for the second time), supplied the materials for the valuable 'Culture Lands of Ancient America' in two stout volumes (1878). The next three years (1878–80) were given to India, Indo-China, and Malaysia (for the third time), and then to North and East Australia, Fiji, Hawaii, California, and Yucatan, one memorable result of which was 'The Religious Myths of the Polynesians' (1881). Then followed at longer intervals the fifth expedition (1878) through Persia, India, and Assam to New Zealand and Hawaii (where Polynesian texts were collected), and thence to the North-Western United States, Mexico, and Yucatan; the sixth (1889–91) through Russian Turkestan to India and East Africa; the seventh (1896–98) chiefly in Java and Bali; the eighth (1901–03) in Ceylon; the ninth and last (1903–05) to Malaysia, Jamaica (where much exhaustive work was given to the cavemen and kitchen middens), Trinidad, Venezuela, and back to Trinidad, where this unwearied collector and explorer literally "died in harness."

And what are the abiding results of all this *improbus labor*? There are, certainly, the magnificent collections which form the chief glory of the Berlin Museum. There are many tens of thousands of square miles of the Earth's surface rapidly surveyed from the great "periegetes'" special standpoint, but without an eye either for their physical features or even for their peculiar characters as the suitable *milieu* of their human inhabitants, whence the remarks of Von den Steinen and of Von Richthofen (another of the speakers at the commemorative gathering) that Bastian was neither a geographer nor an ethnologist in the strict sense of these

terms. Lastly, there is a whole library of psychological writings, which can scarcely be called ethnological, and in any case are well-nigh unreadable—a hopeless tangle of involved constructions without any attempt at form, style, or system, a literary wilderness that has been compared to the sunless Amazonian woodlands, where guide and guided alike are lost in a maze of endless tracks leading anywhere or nowhere. Hence his warmest admirers are fain to confess that this amazing *incongesta moles* was received, volume after volume, with a sad shake of the head, put aside, and then "nicht mehr gelesen" (von den Steinen).

Nevertheless, Bastian has left at least one precious heirloom which should keep his name for ever fresh in the memory of those who have at heart the best interests of anthropological studies. He, more perhaps than any other writer, has helped to establish the psychic unity of mankind on firm ground. Leaving to others the physical characters, the craniology, the comparative anatomy generally, he devoted his exclusive attention to the comparative psychology, to the mental qualities, to the soul, and that he found everywhere one from the lowest Australian and Polynesian to the highest Hellenic and modern types. A peculiarly practical side of his own complex temperament, which made him a shrewd man of business and a great collector, and not merely a mystic or pantheistic dreamer of dreams, enabled him also to give to his ethno-psychology that solid foundation which seems to be lacking in the purely subjective systems of his great fellow-countrymen—Hegel, Fichte, and even Kant—and brings him more into line with the English objective school, as represented especially by Herbert Spencer, Darwin, and Huxley.

A. H. KEANE.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904-1905.

Tenth Meeting, March 27, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Henry James Ashton; Webster Brown, C.E.; William Burnett; Rev. Putman Cady, M.A.; Richard Cooke; Robert W. Dana, M.A., M.I.C.E.; Henry Shalford Dawes; Lieut. Henry Dawson, R.N.R.; Robert Lindsay Forbes; John Hyde; P. B. Joshi; James Knott; Rev. Canon Maccoll, M.A., D.D.; Robert St. John Mathews; Captain Charles Otley Place, D.S.O., R.E.; Captain Charles M. Ritchie, R.H.A.; Captain C. P. Roberts, R.G.A.; Edward Stanislaus Benbow Rowe; Eugene Wihlfahrt.*

The Paper read was:—

"Liberia." By Sir Harry H. Johnston, G.C.M.G., K.C.B.

Eleventh Meeting, April 10, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Eneas Percy Bates, B.A.; Hugh Blakiston; Lieut. Gordon Hargreaves Brown, C.G.; Richard Raymond Carne; Lieut. Robert Sterling Clark, U.S.A.; Joseph Gibson Collinson; Prof. Archibald Cary Coolidge, Ph.D.; Herbert Ashley Cunard Cummins; Captain Bryan Fairfax, Durham Light Infantry; Gustave Gillman; Campbell Login Harrison; R. Fleming Johnston; Edgar Lawn; George Norton Stevens; Major Hugh Stanley Thurston, R.A.M.C.; Erik Tollefsen; Colonel Edward Tufnell, M.P.*

The Paper read was:—

"The Upper Yangtse Provinces." By Colonel Manifold.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Central Europe. **Partsch.**
Mitteleuropa. Die Länder und Völker von den Westalpen und dem Balkan bis an den Kanal und das Kurische Haff dargestellt von Dr. J. Partsch. Gotha: Justus Perthes, 1904. Size 9 × 6, pp. xii. and 464. *Maps. Price* 10*m. Presented by the Publisher.*

This is the original work, revised and brought up to date, of which the English edition, included in the 'Regions of the World' series, was a somewhat abridged translation. Some additions have been made for the benefit of German readers.

Europe—Rainfall. *Petermanns M.* **50** (1904): 281–285. **Kassner.**
Das regenreichste Gebiet Europas. Von Prof. Dr. K. Kassner. *Map.*

The district alluded to is that round the head of the Bay of Cattaro.

France. **Baedeker.**
Northern France from Belgium and the English Channel to the Loire, excluding Paris and its Environs. Handbook for Travellers by K. Baedeker. Fourth Edition. Leipzig: K. Baedeker; London: Dulau & Co. 1905. Size 6½ × 4½, pp. xxxvi. and 424. *Maps and Plans. Price* 7*m. Presented by the Publishers.*

France—Rhône, etc. *B.S.G. Lyon* **19** (1904): 173–202, 272–315. **Turquan.**
Géographie Agricole, Industrielle, Commerciale et Économique du Département du Rhône et Régions environnants. Par V. Turquan. *With Maps.*

Germany—Black Forest. *Deutsch. Rundschau G.* **27** (1904): 110–115. **Koch.**
Zur Entwicklung der Flösserei im Schwarzwalde. Von L. Koch.

Germany—Bremen. *Deutsch. G. Blätter* **27** (1904): 127–146. **Tetens.**
Ueber Bremens Bedeutung als Handelsplatz. Vortrag von Dr. F. Tetens. *Map and Diagrams.*

Germany—Odenwald. *Forsch. deutsch. Landes- u. Volkskunde* **15** (1904): 237–289. **Jaeger.**
Ueber Oberflächengestaltung im Odenwald. Von Dr. F. Jaeger. *With Map.*

Germany—Saxony. *Z.K. Sächs. Statist. Bureaus* **50** (1904): 161–172. **Wiechel.**
Eine Volksdichte-Schichtenkarte von Sachsen in neuer Entwurfsart. Von H. Wiechel. *With Map.*

Holland—Sea-level. *K. Ned. Meteorolog. I.*, No. 90 (1904): pp. 22. **Van der Stok.**
Etudes des phenomènes de marée sur les Côtes Néerlandaises. 1. Analyse des mouvements périodiques et apériodiques du niveau de la mer. Par J. P. van der Stok.

Iceland. *Oversigt K. Danske Vidensk. S. Forhand.* (1904): 217-267. **Pjetursson.**
Om nogle glaciale og interglaciale Vulkaner paa Island. Af H. Pjetursson.

Iceland—Forests. *G. Tidskrift* 17 (1903-1904): 238-241. **Prytz.**
Lidt om Trævækslen paa Island. Af Prof. C. V. Prytz. *Illustrations.*

Cf. note in *Journal* for September, 1904 (p. 346).

Italy. *Ann. G.* 13 (1904): 348-360. **Besnier.**
La Conque de Sulmona. Par M. Besnier. *With Plate.*

This refers to a district in the Abruzzi intercalated between the parallel folds of the Central Appenines. The author sketches the human as well as the physical geography.

Italy—Genoa. **Léotard.**
Une visite à Gênes. Comparaison avec Marseille. Par J. Léotard. (Extrait du *Sémaphore* et du *Bulletin* de la Société.) Marseille, 1904. Size 10 × 6½, pp. 32. *Plans and Illustration. Presented by the Author.*

Italy—Vesuvius. *B.S. Belge Géologie* 18 (1904): (*Proc.-Verb.*) 228-231. **Brun.**
La dernière éruption du Vésuve. Par A. Brun.

Mediterranean. *C.Rd.* 139 (1904): 379-381. **Negris.**
Nouvelles observations sur la dernière transgression de la Méditerranée. Note de P. Negris.

See note in the *Journal* for October, 1904 (p. 483).

North-West Europe—Hydrography. **Krümmel.**
Die Deutschen Meere im Rahmen der internationalen Meeresforschung. Offentlicher Vortrag, gehalten im Institut für Meereskunde am 5. und 6. März 1903. Von Dr. O. Krümmel. (Veröffentl. I. Meereskunde, etc., Heft 6, 1904.) Berlin: E. S. Mittler und Sohn. Size 10½ × 7½, pp. 36. *Maps.*

Pyrenees. *Questions Dipl.* 18 (1904): 529-540. **Lorin.**
Les chemins de fer transpyrénéens. Par Prof. H. Lorin.

Russia. *G.Z.* 10 (1904): 481-506, 537-569, 600-626, 666-691. **Hettner.**
Das europäische Russland. Eine anthropogeographische Studie. Von A. Hettner. *Also separate copy, presented by the Author.*

A careful study of human life and activity in Russia as conditioned by physical geography.

Russia. ———
Bulletin Russe de Statistique, Financière et de Législation. Année 1904. Livraison 1. St.-Pétersbourg, Imp. V. Kirschbaum, 1904. Size 11 × 7, pp. 176.

Russia—Finland. *Deutsch. G. Blätter* 27 (1904): 176-188. **Karstedt.**
Die südfinnische Skärenküste von Wiborg bis Hangö. Von F. O. Karstedt.

Russia—Ural. *Izvestiya Imp. Russ. G.S.* 40 (1904): 161-166. **Savelief.**
Third journey in the Ural. By R. Savelief. [In Russian.]

Russia—Urals. *B. Comité Géolog. St.-Pétersbourg* 22 (1903): 417-436. **Koniuschevsky.**
Compte rendu préliminaire sur les recherches géologiques faites en 1902 dans l'Oural du sud. Par — Koniouschevsky. [In Russian.]

Spain. *C. Rd.* 139 (1904): 894-896. **Douvillé.**
Sur les Préalpes subbétiques au sud du Guadalquivir. Note de R. Douvillé.

Sweden—Anthropogeography. *Ymer* 24 (1904): 314-331. **Andersson.**
Om de fysiskt-geografiska förutsattningarna för bebyggelsen inom några af Jämtlands fjälltrakter. Af G. Andersson. *Map and Illustrations.*

On the physical conditions determining settlement in some mountainous districts of Jämtland.

United Kingdom—Archæology. **Hubbard.**
Neolithic Dew-Ponds and Cattle-Ways. By A. J. Hubbard and G. Hubbard. London: Longmans & Co., 1905. Size 10 × 7, pp. x. and 70. *Illustrations. Price 3s. 6d. net. Presented by the Publishers.*

Shows reason for believing that some of the dew-ponds and cattle-tracks on the Downs date from Neolithic times.

ASIA.

Asia. **Zichy.**
Dritte Asiatische Forschungsreise des Grafen Eugen Zichy. Band vi. Forschungen im osten zur Aufhellung des Ursprunges der Magyaren. Geschichtliche Uebersicht und meine Wahrnehmungen, Erfahrungen mit besonderer Berüchsichtigung der Ergebnisse meiner Expeditionen. Von Graf E. Zichy. Budapest; Leipzig: K. W. Hiersemann, 1905. Size 12½ × 9½, pp. 304. *Maps and Illustrations. Price* 20*s.*

This volume includes an historical sketch of Hungarian expeditions and researches in the past; a sketch of the scientific results of Count Zichy's own journey; and a personal narrative of the same. It is excellently illustrated from photographs.

Caspian Sea. *Petermanns M.* **50** (1904): 291–294. **Knipowitsch.**
Hydrobiologische Untersuchungen des Kaspischen Meeres. Reiseberichte von N. Knipowitsch.

China—Population. **Rockhill.**
Inquiry into the Population of China. By W. W. Rockhill. (From *Smithsonian Misc. Coll.* (*Quarterly Issue*), vol. 47, part 3.) Washington, 1904. Size 10 × 6½, pp. 303–321. *Presented by the Author.*

Noticed in the Monthly Record for March (p. 327).

Chinese Empire—Tibet. **Landon.**
Lhasa: an Account of the Country and People of Central Tibet, and of the Progress of the Mission sent there by the English Government in the year 1903–4. Written, with the help of all the principal persons of the mission, by Perceval Landon. 2 vols. London: Hurst and Blackett, 1905. Size 10 × 7, pp. (vol. 1) xx. and 414; (vol. 2) xii. and 426. *Maps and Illustrations. Price* 42*s. net. Presented by the Publishers.* [Reviewed in the present number, p. 551.]

Chinese Empire—Tibet. **Millington.**
To Lhassa at Last. By P. Millington. Second Edition. London: Smith, Elder & Co., 1905. Size 8 × 5½, pp. x. and 200. *Frontispiece. Price* 3*s.* 6*d. net. Presented by the Publishers.* [See p. 553, *ante.*]

Eastern Asia. ———
Handbook of Information for Shippers and Passengers by the Steamers of the Nippon Yusen Kaisha (Japan Mail S.S. Co., Ltd.). 1904. Size 9 × 6, pp. iv. and 348. *Maps and Illustrations.*

French Indo-China. **Doumer.**
Paul Doumer. L'Indo-Chine française (Souvenirs). Paris: Vuibert et Nony, 1905. Size 12½ × 8½, pp. xvi. and 392. *Maps and Illustrations. Price* 8*s.* 6*d.*

Presents M. Doumer's personal impressions and experiences during his tenure of the governor-generalship of Indo-China, with appreciations of the present position and prospects of that region.

French Indo-China—Laos. *B. Comité l'Asie Française* **4** (1904): 523–532. **Danchaud.**
Le climat de France sous les tropiques: le plateau du Tran-ninh. Par le Capitaine Danchaud. *Maps.*

India. *Tour du Monde* **10** (1904): 157–216, 373–408. **Boeck.**
Mes Voyages aux Indes et au Népal. Par le Docteur K. Boeck. Adapté de l'allemand par F. Ricard. *Map and Illustrations.*

India. **Bradley-Birt.**
The Story of an Indian Upland. By F. B. Bradley-Birt. And an Introduction by the Hon. H. H. Risley. London: Smith, Elder & Co., 1905. Size 9½ × 6, pp. xii. and 354. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

This book supplies the general reader for the first time with a history and description of the "Santal Perganas" inhabited by some of the most interesting of the aboriginal tribes of Central India, of which no satisfactory general account had previously been in existence.

India—Census. ———
Census of India, 1901, vols. i., i.-A. Part i. Report. Part ii. Tables. By H. H. Risley and E. A. Gait. Calcutta: 1903. Size 13½ × 8½, pp. (vol i.) 582; (vol. i.-A 492. *Price* (vol. i.) 7*s.* 6*d.*; (vol. i.-A) 6*s.*
Ditto, Ethnographic Appendices. By H. H. Risley. Calcutta: 1903. Pp. 251. *Maps. Price* 4*s.* 6*d.*

Noticed in the February number (p. 197).

India—Population. *J.R. Statistical S.* 67 (1904): 661–670. **Baines.**
The Geographical Distribution of Population in India. By J. A. Baines, C.S.I. *With Diagram. Also separate copy.*

Japan—Magnetic Survey. **Tanakadate.**
J. College Sci., Imp. University Tōkyō 14 (1904) : pp. xii., 180, and 348.
A Magnetic Survey of Japan reduced to the Epoch 1895.0 and the Sea Level, carried out by order of the Earthquake Investigation Committee. Reported by Prof. A. Tanakadate. *With Maps and Plates.*

Japan—Sea-level. **Omori.**
Note on the Annual Variation of the Height of Sea-level at Ayukawa and Misaki. By F. Omori. (Publications Earthquake Investigation Committee in Foreign Languages, No. 18, pp. 23–26.) Tōkyō, 1904. Size 10½ × 7½. *Diagram.*

Korea. *B.S.G. Rochefort* 26 (1904): 216–225. **Pawlowski.**
Historique de la connaissance de la Corée d'après la cartographie. Par A. Pawlowski.

Korea. *Nouv. Archiv. Miss. Sci.* 12 (1904): 131-141. **Bourdaret.**
Rapport sur une Mission Scientifique en Corée. Par É. Bourdaret.

The writer, who went out to Korea to study the question of railways, occupied his spare time in anthropological and natural history research. The greater part of the paper deals with anthropology.

Korea. **Ducrocq.**
Georges Ducrocq. Pauvre et Douce Corée. Quatrième Édition. Paris: H. Champion, 1904. Size 7½ × 5½, pp. 88. *Illustrations. Presented by the Publisher.*

Malay Archipelago—Tides. *Ann. Hydrographie* 32 (1904): 363–371. **Meyer.**
Die Gezeiten im Ostindischen Archipel. Von H. Meyer.

Malay Archipelago—Timor. **Grijzen.**
Verh. Batav. Genoots. Kunsten en Wetens. 54 (3) (1904): pp. 146.
Mededeelingen omtrent Beloe of Midden-Timor. Door H. J. Grijzen.

Manchuria. *Mem. Imp. Russ. G.S.* (*Gen. G.*) 35 (1904): pp. 566. **Anert.**
Journey through Manchuria [Expeditions of 1896 and 1897–98]. E. E. Anert. [In Russian.] *With Maps and Illustrations.*

This important work will be reviewed elsewhere.

Russia—Siberia. *Petermanns M.* 50 (1904): 285–290. **Breitfuss.**
Zur Frage über den Sibirischen Seeweg nach Osten. Von Dr. L. Breitfuss. *With Map.*

AFRICA.

East Africa—Masai. **Hollis.**
The Masai, their Language and Folklore. By A. C. Hollis. With Introduction by Sir Charles Eliot. Oxford: Clarendon Press, 1905. Size 9 × 6, pp. xxviii. and 360. *Map and Illustrations. Price 14s. net. Two copies, presented by the Publishers.*

Eritrea. *B.S.G. Italiana* 5 (1904): 782–786. **Marini.**
Il rilievo topografico della Colonia Eritrea. Nota del Prof. A. Marini. *With Map.*

Fernando Po. *J. Manchester G.S.* 20 (1904): 29–36. **Nunan.**
Fernando Po, West Africa. By T. J. Nunan.

The writer has resided in the island.

French Guinea. *B.S.G. Italiana* 5 (1904): 786–795. **Joûbert.**
Le Isole di Loos, e Conacri (Africa occidentale). Nota del J. Joûbert. *With Map.*

French Guinea—Frontier. **Meyreuil.**
Renseign. Col. Com. Afrique Franç. (1904): 253-257.
La Mission Maclaud. La Delimitation de la Frontière entre la Guinée Française, la Casamance et la Guinée Portugaise. Par A. Meyreuil. *With Map.*

German South-West Africa. *T. Geolog. S. South Africa* 7 (1904): 77–94. **Voit.**
A Contribution to the Geology of German South-West Africa. By F. W. Voit. *Map with Sections.*

Gold Coast. **Crowther.**

The Gold Coast Civil Service List (1904-5). Compiled by F. Crowther. London: E. Stanford, 1904. Size 10 × 6½, pp. 442. *Map. Price 6s. Presented by the Publisher.*

A valuable publication, giving much useful information on public works, frontier delimitation, official regulations, etc., etc.

Kamerun. *Deutsch. Kolonialzeitung* 22 (1905): 70–72. **Moisel.**

Die Expedition Stieber in das Musgugebeit und die Wasserstrasse Garua-Tschad. Von M. Moisel. *With Map.*

Captain Stieber, who examined the country on the left bank of the Lagone near the Tuburi lake, does not share Captain Lenfant's sanguine anticipations as to the possibilities of this route to Lake Chad (see *ante*, p. 567).

Kamerun. *Globus* 86 (1904): 273-278, 337-344. **Lessner.**

Die Baluë- oder Rumpiberge und ihre Bewohner. Von Oberleutnant Lessner. *With Illustrations.*

Madagascar—Railway. *Rev. Madagascar* 6 (1904): 509-559. ———

Inauguration du chemin de fer de Tananarive à la Mer. *Maps.*

Morocco. *Renseign. Col. Com. Afrique Franç.* (1904): 221-243, 258-274. **Bernard.**

Une Mission au Maroc. Rapport à M. le Gouverneur Général de l'Algérie. Par A. Bernard. *With Map.*

Nigeria. **Bedwell.**

Southern Nigeria. Report for 1903. Colonial Reports, Annual No. 433, 1904. Size 9½ × 6, pp. 48. *Price 3s.*

Nile. **Willcocks.**

The Nile in 1904. By Sir W. Willcocks, K.C.M.G. London: E. & F. N. Spon, 1904. Size 10½ × 7½, pp. 226. *Maps and Sections. Price 9s. net. Presented by the Author.* [To be reviewed.]

Uganda. **Cunningham**

Uganda and its Peoples. Notes on the Protectorate of Uganda, especially the Anthropology and Ethnology of its Indigenous Races. By J. F. Cunningham. With a Preface by Sir Harry Johnston, G.C.M.G. London: Hutchinson & Co., 1905. Size 10 × 7½, pp. xxx. and 370. *Map and Illustrations. Price 24s. net. Presented by the Publishers.* [To be reviewed.]

NORTH AMERICA.

Canada—Selkirk Range. *Appalachia* 10 (1904): 404-408. **Wheeler.**

Notes on the Altitude of Mts. Columbia, Bryce, Lyell, and Forbes. By A. O. Wheeler.

See note in the March number, p. 328.

Mexico. *Mem. y Rev. S. Ci. "Antonio Alzate"* 18 (1902): 83-112. **Ordoñez.**

Le Xinantecatl ou Volcan Nevado de Toluca. Par E. Ordoñez. *With Plates.*

Mexico. **Ordoñez and Prado y Tapia.**

Mem. y Rev. S. Ci. "Antonio Alzate" 18 (1902): 257-265.

Los Volcanes de Zacapu, Michoacan. Por E. Ordoñez y F. Prado y Tapia. *With Map.*

Mexico. ———

Mexico. Geographical Sketch, Natural Resources, Laws, Economic Conditions, Actual Development, Prospects of Future Growth. Edited and compiled by the International Bureau of the American Republics. 1904. Washington, 1904. Size 9½ × 6, pp. 454. *Illustrations. Presented by the International Bureau of the American Republics.*

North America. *B. Geolog. S. America* 14 (1903): 207-226. **Spencer.**

Submarine Valleys off the American Coast and in the North Atlantic. By J. W. Spencer. *With Maps.*

North America—Early Travels. **Thwaites.**

New Voyages to North America by the Baron de Lahontan. Reprinted from the English edition of 1703, with facsimiles of original title-pages, maps, and illustrations, and the addition of Introduction, Notes, and Index, by R. G. Thwaites, LL.D. 2 vols. Chicago: A. C. McClurg & Co., 1905. Size 8½ × 6, pp. xciv. and 798. *Price* $7.50.

United States. *J.G.* 3 (1904): 243–310. **Brigham and others.**
The Geography of the Louisiana Purchase. *With Maps and Illustrations.*

Includes a number of articles by different writers, the first, by Prof. Brigham, treating of the geographical importance of the Louisiana purchase.

United States. *Symons's Meteorolog. Mag.* 39 (1904): 181–185. **Mill.**
The Vengeance of the Rain Gods. By the Editor.

Describes a visit to the Grand canyon and a Navaho village, with a subsequent unwonted deluge, no doubt attributed by the Indians to the carrying away of their rain-gods by an American man of science.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Bernárdez.**
The Land of Promise for Labour and Small Capital. The Argentine Estancia. A review of the Live-Stock and Agricultural industries, and of the rural prospects of the Argentine Republic. By M. Bernárdez. Buenos Aires, 1903. Size 10½ × 7½, pp. viii. and 124. *Maps and Illustrations.*

Argentine Republic. **Martinez.**
Manual del Viajero. Baedeker de la República Argentina. Par A. B. Martinez. 2ª Edición. Buenos Aires, 1904. Size 7½ × 5, pp. xvi. and 384. *Maps, Plans, and Illustrations.*

Argentine and Uruguay. ——
St Louis Exhibition. Argentine Republic. Ministry of Public Works, Direction-General of Hydraulic Works. Project for improving the Navigability of the River Plate and Concordia. Explanatory Index of the Objects exhibited. Buenos Aires, 1904. Size 10½ × 7, pp. 82.

Bolivia. ——
Bolivia. Geographical Sketch, Natural Resources, Laws, Economic Conditions, Actual Development, Prospects of Future Growth. Edited and compiled by the International Bureau of the American Republics, 1904. Washington, 1904. Size 9½ × 6, pp. 214. *Illustrations. Presented by the International Bureau of the American Republics.*

Bolivia—Trade. *B. Oficina Nac. Inmigración La Paz* 4 (1904): pp. 326. ——
Resumen estadistico del comercio exterior de Bolivia correspondiente al año de 1903.

Brazil. *Globus* 86 (1904): 346–349. ——
Dr. Herrmann Meyers deutsche Ackerbau-Kolonien in Südbrasilien. *With Illustrations.*

Chile—Earthquakes. **Goll.**
Die Erdbeben Chiles. Ein Verzeichnis der Erdbeben und Vulkanausbrüche in Chile bis zum Ende des Jahres 1879 nebst einigen allgemeinen Bemerkungen zu diesen Erdbeben. Von Dr. F. Goll. (Münchener geographische Studien, herausgegeben von S. Günther. Vierzehntes Stück.) Munchen: T. Ackermann, 1904. Size 9 × 6, pp. vi. and 138. *Diagram.*

Dutch Guiana. **Stockum.**
Tijdsch. K. Ned. Aardrijk. Genoot. 21 (1904): 88–122, 227–310, 651–721, 822–878, 1022–1069.
Verslag van de Saramacca-Epeditie. Door A. J. Van Stockum. *Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Sturt's Expedition. **Blacket.**
P.R.G.S. Australasia: S. Australian Br. 7 (1904): 66–69.
An Interesting Discovery. By the Rev. J. Blacket.

On the recent discovery of a part of Captain Sturt's MS. *Journal* (see *ante*, p. 331).

Caroline Islands. *M. Deutsch. Schutzgeb.* 17 (1904): 192–197. **Senfft.**
Bericht über den Besuch einiger Inselgruppen der West-Karolinen. Von — Senfft.

Caroline Islands—Uleai. *M. Deutsch. Schutzgeb.* 17 (1904): 175–191. **Born.**
Einige Beobachtungen ethnographischer Natur über die Oleaï-Inseln. Von Dr. Born.

New Guinea. *J. Manchester G.S.* **20** (1904): 8–28. **McFarlane.**
My Experiences as a Pioneer Missionary amongst the Cannibals of New Guinea. By Rev. S. McFarlane, LL.D. *Illustrations.*

New Guinea. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **22** (1905): 360–371. **Ijzerman.**
De Nieuw-Guinea-Expeditie van het Koninklijk Nederlandsch Aardrijkskundig Genootschap. Door J. W. Ijzerman.

Various reports from members of this expedition (cf. *ante*, p. 97) are here printed, bringing the chronicle of events down to December last.

Pacific. *M. Deutsch. Schutzgeb.* **17** (1904): 208–216. **Moisel.**
Begleitworte zu der Karte "Neue Aufnahmen aus der Südsee." Von M. Moisel. *With Map.*

POLAR REGIONS.

Antarctic—Climate. *Ymer* **24** (1904): 297–313. **Bodman.**
Om Klimatet i Antarktis med särskild hänsyn till Graham Land. Af G. Bodman. *Sketch-map and Illustrations.*

Greenland. *Meddelelser om Grønland* **26** (1904): 1–70. **Engell.**
Undersøgelser og Opmaalinger ved Jakobshavns Isfjord og i orpigsuit i sommeren 1902. Af M. C. Engell. *Maps and Ilustrations.*

Greenland. *Meddelelser om Grønland* **26** (1904): 407–434. **Krogh.**
The Abnormal CO_2 Percentage in the Air in Greenland, and the General Relations between Atmospheric and Oceanic Carbonic Acid. By A. Krogh.

Greenland. *Meddelelser om Grønland* **26** (1904): 71–89. **Schjørring.**
Trekantnettet langs Jakobshavns Isbræ og dets Bestemmelse. Af H. Schjørring. *Diagram.*

On a trigonometrical survey of the Jakobshavn glacier.

Greenland—Eskimo Immigration. **Schultz-Lorentzen.**
Meddelelser om Grønland **26** (1904): 289–330.
Eskimoernes Indvandring i Grønland. Af Schultz-Lorentzen.

MATHEMATICAL GEOGRAPHY.

Astronomy. ——
Appendix to Nautical Almanac, 1905. Corrections to the Apparent Places of Nautical Almanac Stars visible at Greenwich. Size 9½ × 6½, pp. 22.

Cartography. *National G. Mag.* **15** (1904): 405–408. **Penck.**
Recent Progress in the Execution of a Map of the World on the Uniform Scale of 1 : 1,000,000. By Dr. A. Penck.

Cartography—Korean Map. *B. American G.S.* **36** (1904): 600–605. **Hulbert.**
An Ancient Map of the World. By H. B. Hulbert. *Illustrations.*

On the Korean map referred to in Mr. Collyer's paper (*Journal*, vol. **23**, p. 486).

Cartography—Projection. *Petermanns M.* **50** (1904): 277–281. **Hammer.**
Zwei praktische Beispiele schiefachsiger zylindrisher Kartennetzentwürfe. Von Prof. Dr. E. Hammer. *With Plate.*

Longitude Determination. *C. Rd.* **139** (1904): 1010–1015. **Lœwy.**
Détermination faite en 1902 de la différence de longitude entre les méridiens de Greenwich et de Paris. Note de M. Lœwy.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Launay.**
La Science Géologique, ses méthodes, ses résultats, ses problèmes, son histoire. Par L. de Launay. Paris: A. Colin, 1905. Size 10 × 6½, pp. 750. *Maps and Illustrations. Price* 20 *fr. Presented by the Publisher.*

Meteorology. ——
Kaiserliche Marine, Deutsche Seewarte. Tabellarische Reiseberichte nach den meteorologischen Schiffstagebüchern. I. Band. Eingänge des Jahres 1903. Berlin: E. S. Mittler und Sohn, 1904. Size 10½ × 7½, pp. viii. and 184. *Price* 3*m. Presented by the Publishers.*

Oceanography. **Ruppin.**
Zweiter Beitrag zur Bestimmung und Verwertung des Gasgehaltes des Meerwassers. Von Dr. E. Ruppin. (Separatabdruck aus: Wissenschaftliche Meeresuntersuchungen. Abt. Kiel. N. F. Band 8.) Kiel, 1904. Size 13½ × 10½, pp. 127–134. *Diagram. Presented.*

Oceanography—Bathymetric Map. **Thoulet.**
B. Musée Océanograph. Monaco, No. 21 (1904): pp. 28.
Carte bathymétrique générale de l'Océan. Par J. Thoulet. *Map.*

Physical Geography. *J. Geology* 12 (1904): 524–550. **Russell.**
Physiographic Problems of To-day. By I. C. Russell.

Ripple-Marks. *Naturw. Wochenschrift* 3 (1904): 1025–1031. **Geinitz.**
Bilder von Windwirkungen am Strande. Von F. E. Geinitz. *With Illustrations.*

Rivers. *B. American G.S.* 36 (1904): 589–599. **Tower.**
The Development of Cut-off Meanders. By W. S. Tower. *With Illustrations.*

Surface Features. *Smithsonian Contrib. Knowledge* 34, No. 1438 (1903): pp. 80. **Shaler.**
A Comparison of the Features of the Earth and the Moon. By Prof. N. S. Shaler. *Plates.*

Zoogeography. *G. Tidskrift* 17 (1903–1904): 229–238. **Wesenberg-Lund.**
Om en nulevende i vore Søer indelukket marin arktisk Istidsfauna. Af Dr. C. Wesenberg-Lund.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *J.G.* 3 (1904): 409–412. **Whitbeck.**
Response to Surroundings—A Geographic Principle. By R. H. Whitbeck.

Exploration. *National G. Mag.* 15 (1904): 392–404. **Chester.**
Some Early Geographers of the United States. By Rear-Admiral C. M. Chester.

Historical—Alfred the Great. **Geidel.**
Alfred der Grosse als Geograph. Von Dr. H. Geidel. (Münchener geographische Studien, herausgegeben von S. Günther. Fünfzehntes Stück.) München: T. Ackermann, 1904. Size 9 × 6, pp. 106.

Historical—Columbus. **Vignaud.**
Études critiques sur la vie de Colomb avant ses découvertes. . . . Par H. Vignaud. Paris: H. Welter, 1905. Size 9 × 6½, pp. xvi. and 544. *Price* 10 *fr. Presented by the Publisher.*

Historical—Portuguese Conquests. **Emanuel.**
Epistola Potentissimi ac inuictissimi Emanuelis Regis Portugaliæ et Algarbiorum, etc. De Victoriis habitis in India and Malacha. Ad. S. in Christo Patrem et Dñm nostrum Dñm Leonem X. Pont. Maximum. Romæ, 1513. [Facsimile.] Size 8½ × 6, pp. [12].

Historical—Pytheas. **Eitel.**
P.R.G.S. Australasia: S. Australian Br. 7 (1904): 30–47.
The First Polar Expedition, 325 B.C. By Rev. Dr. Eitel.

BIOGRAPHY.

Brard. *B.S.G. Marseille* 28 (1904): 129–134. **Hamy.**
Jean-Nicholas Brard, peintre-naturaliste provençal, explorateur des Antilles (1748–1822). Notice biographique par le Dr. E.-T. Hamy.

Kuropatkin. *B.S.G. Lyon* 19 (1904): 316–319. ——
Le Général Kouropatkine explorateur et géographe.

Stanford. *Publishers' Circular* 81 (1904): 581. **Marston.**
Edward Stanford. A Personal Reminiscence. By E. Marston. *Portrait.*

GENERAL.

International Congress. *National G. Mag.* 15 (1904): 387–392. **Peary.**
Address by Commander Robert E. Peary on the Assembling of the Eighth International Geographic Congress in Washington.

Petermanns Mitteilungen. *Petermanns M.* 50 (1904): 275–277. **Supan.**
Zum Abschluss des 50 Bandes von Petermanns Mitteilungen. Von Prof. Dr. A. Supan.

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11, 12; XI. 1, 2, 3, 4, 5, 6, 8, 10, 11, 12; XII. 5, 9, 10. **Devonshire**, IVA. 6; XXXI. 8; LV. 3, 4, 6, 8, 12, 14, 16; LVI. 14, 15, 16; LXVII. 2, 3, 4, 6, 7, 8, 10, 11, 12; LXVIII. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12; LXIX. 1, 5, 9; LXXXII. 9; XCIII. 15, 16; (CIII. 4 and CIIIA. 1). **Herefordshire**, XIII. 6; XIV. 11; XXI. 4, 12, 16; XXII. 1, 5; XXVIII. 4; XXIX. 1, 2, 6, 10, 14; XXXVI. 2, 3, 6, 7, (10 and 11), 14; XLII. 2, 6. **Lincolnshire**, CIII. 4, 8, 12; CIV. 5, 9, 10, 14, 16; CV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CVI. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXVI. 16; CXVII. 6, 8, 12. **Norfolk**, XCI. 5, 6, 8, 10, 11, 12, 16; XCII. 10, 14; XCIII. 7, 8, 9, 10, 11, 13; XCIV. 6, 7, 8, 9, 10, 12, 14, 15, 16; XCV. 1, 2, 3, 4, 5, 7, 9, 10, 11, 12, 13, 14, 15, 16; XCVI. 10, 13, 14; CII. 8; CIII. 2, 3, 4; CIV. 7, 8, 12; CV. 13; CVI. 13; CX. 2. **Radnorshire**, XIV. 2, 6, 10. **Somerset**, VI. 7. **Suffolk**, V. 16; VI. 14; VII. 9, 10, 13; XXV. 2; XXVIII. 11. **Warwickshire**, XXII. 2, 15; XXVI. 10; XXVIII. 1, 4, 5, 7, 8, 9, 11, 12; XXIX. 1, 5, 9; XXXI. 6, 10, 11; XLIII. 9, 10. **Worcestershire**, XXVI. 2, 5; XXXII. 2, 3, 6, 9, 10, 14, 15; XXXIX. 2, 3, 16; XLVI. 4, 8, 12, 16; LIII. 4. **Yorkshire** (First Revision of 1891 Survey), CCLXXXVIII. 7, 11, 12. 3*s. each.*

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Iceland. **Thoroddsen.**

Die Bruchlinien Islands von Th. Thoroddsen. Scale 1 : 2,300,000 or 36·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 6. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Macedonia. **Reimer.**

Karte der christlichen Schulen in Macedonien. Nebst erläuterndem Text "Die christlichen Schulen in Macedonien." Scale 1 : 400,000 or 6·3 stat. miles to an inch. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Price* 6*m.*

An outline map of Macedonia, showing by coloured symbols, Greek, Bulgarian, Rumanian, and Servian schools, Greek churches and monasteries, and other information and statistics of a kindred nature. This map is accompanied by twelve pages of letterpress.

Russian Empire. **Koverski.**

Map of the Russian Empire and Neighbouring Countries. By Lieut.-General E. Koverski. Scale 1 : 8,400,000 or 132·6 stat. miles to an inch. 4 sheets. St. Petersburg: Ministry of Ways and Communications, 1904. [In Russian.]

This map includes, not only the Russian Empire, but the greater part of Europe, and the whole of Northern and Central Asia. It gives travellers' routes, railways, principal roads, telegraphs, steamer lines, besides information concerning the physical characteristics of the country. There is no hill work; but even without this, owing to the numerous lines of one kind and another, the map has a somewhat confused appearance in some parts. However, much information can be obtained from it by a careful and close inspection. Copious notes are given at the side and bottom of the map, but these are, of course, in Russian.

Switzerland. **Kummerly.**

Carte Générale de la Suisse. Par H. Kummerly. Scale 1 : 400,000 or 6·3 stat. miles to an inch. With Index. Bern: H. Kummerly & Frey and A. Francke, [1904].

A well-drawn general map of Switzerland and parts of the adjacent countries, artistically printed in colours. The relief is shown by shading and oblique illumination, and on the whole the effect is graphic and good; but in some instances, as is often the case with this style, unless it is combined with contours, the proper relation between the slopes is hardly indicated, the darker slopes appearing steeper than they really are owing to the deeper shade. However, the general result is most satisfactory, and the map is well brought up to date, as is evidenced, amongst other things, by the Simplon tunnel being shown.

Switzerland. **Machaček.**

Kartenskizze der Flussentwicklung im Berner Jura. Von Dr. F. Machaček. Scale 1 : 200,000 or 3·1 stat. miles to an inch.—Geologische Profile aus dem Berner Jura. Von Dr. F. Machaček. *Petermanns Geographische Mitteilungen*, Ergänzungsheft No. 150, Tafeln 1 u. 2. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

ASIA.

Asia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1 : 1,168,031 or 18·4 stat. miles to an inch. Sheets (new editions): XIV., Urga; XXII., Lanchau. St. Petersburg: Military Topographical Department, 1903. [In Russian.]

China. **Stanford.**

A large-scale map of the Peking Syndicate Railway, showing the density of population along the route. Scale 1 : 411,840 or 6·5 stat. miles to an inch. London: Edward Stanford, 1905.

Manchuria. **Topographical Section, General Staff.**

Map of the Country North of T'ieh-ling, to illustrate the Campaign in Manchuria (provisional issue without hills). Scale 1 : 420,000 or 6·7 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price 2s. Presented by the Director of Military Operations.*

This map is a continuation northwards of that showing the country round Mukden, and includes Kirin. It is enlarged from the Russian Staff Map on the scale of 1 : 840,000, with additions from the 1 : 1,680,000 map of the same department.

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Lagos, 73-C, 73-D, 73-G; Northern Nigeria, 74-A, 74-B, 74-C, 74-D; Southern Nigeria, 73-H, 73-L, 73-P, 74-E, 74-F, 74-G. London: Topographical Section, General Staff, War Office, 1905. *Price 1s. 6d. each sheet. Presented by the Director of Military Operations.*

Egypt. **Topographical Section, General Staff.**

Map of Egypt. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price 4s. 6d. Presented by the Director of Military Operations.*

Eritrea. **Instituto Geografico Militare, Florence.**

Carta della Colonia Eritrea. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 14, Gruta; 21, Zula; 21 *bis*, Harĕna; 28, Buia; 28 *bis*, Samoti; 34, Endĕli. Florence: Instituto Geografico Militare. *Price* 1.5 *lire each sheet.*

German South-West Africa. **Woerner.**

Karte des Geländes zwischen Rehoboth und Gibeon sowie der Heliographenlinie Windhuk-Gibeon, konstruiert und gezeichnet von Oberleutnant Woerner. Scale 1 : 200,000 or 4·2 stat. miles to an inch.—Karte der Heliographenlinie Karibib-Outjo sowie der Wege zwischen Etiro und Outjo, konstruiert und gezeichnet von Oberleutnant Woerner. Scale 1 : 200,000 or 4·2 stat. miles to an inch. *Mitteilungen aus den deutschen Schutzgebieten*, Band xvi., Karten 3 u. 4. Berlin: E. S. Mittler u. Sohn, 1903.

These are good specimens of route traverses. All survey points and heliograph stations are marked, and the lines connecting the latter are indicated by a broken black line. Many useful notes appear on the map concerning the character of the country, water-supply, animal life, etc. The relief is shown by horizontal form lines in brown. No latitudes or longitudes are given on the maps.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: LIV., Sidi Ali Ben Aoun; LVI., El Aguareb. Paris: Service Géographique de l'Armée, [1905]. *Price* 1.20 *fr. each sheet.*

Zambezi River. **Stanford.**

River Zambezi from Zumbo to the Victoria Falls. Scale 1 : 250,000 or 3·9 stat.

miles to an inch. 3 sheets. London: Edward Stanford. *Presented by the British South Africa Company.*

The river is shown in blue, with names and notes concerning breadth, navigability, rapids, etc., from Major Gibbons, in black. The map is evidently only provisional, and the river is shown as about the same breadth throughout the whole of the course, no narrowing in at the gorges and rapids being indicated. In some respects it differs from the survey made by Major Gibbons from September to December, 1890. No soundings are given, and no information as to the average depth of water at different seasons.

AMERICA.

Canada. **Surveyor-General of Canada.**

Sectional Map of Canada. Scale 1: 190,080 or 3 stat. miles to an inch. Battleford Sheet (62), West of Third Meridian, revised to September 28, 1904; Ribston Creek Sheet (70), West of Fourth Meridian, revised to October 17, 1904; Rocky Mountain House Sheet (85), West of Fifth Meridian, revised to October 17, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

GENERAL.

World. **Johnston.**

Johnstons' Commercial and Library Chart of the World on Mercator's Projection, from the latest and best authorities, containing the position of every place of commercial importance, showing the principal Ocean Currents and the Chief Steamship Routes. 4 sheets. Edinburgh and London: W. & A. K. Johnston, [1905]. *Price, mounted on rollers and varnished, £3 3s. Presented by the Publisher.*

Johnstons' Commercial and Library Chart of the World is well known, having already passed through several editions. It has been again revised and brought up to date. All important corrections appear to have been made, and the map, or chart as the publishers choose to call it, will doubtless be of great service in offices and commercial establishments. It can be obtained in four sheets, or mounted on rollers and varnished.

World. **Johnston.**

The Royal Atlas of Modern Geography exhibiting, in a series of entirely original and authentic maps, the present condition of Geographical Discovery and Research in the several Countries, Empires, and States of the World. By the late Alexander Keith Johnston, with additions and corrections to the present date by G. H. Johnston. New Edition. Edinburgh and London: W. & A. K. Johnston, 1905. *Price £6 6s. Presented by the Publishers.*

Although the title-page and preface of this edition bear the date 1905, and in the latter it is stated that the atlas has been "brought thoroughly up to date," it is in many respects considerably behind the times.

It is true that in the lower left-hand corner of the maps different dates appear, in small figures, contradicting the title-page and preface, but these are almost certain to be overlooked, and naturally it will be supposed that the atlas has been brought up to the present year as stated. In the map of the North Polar Regions (frontispiece), there is no indication of the important discoveries and explorations of Captain O. Sverdrup to the north-west of Jones sound, and the same serious omission is noticeable on the map of North America. On map No. 40, Africa, the boundary between Northern Nigeria and French Sudan is wrongly laid down. Maps 54 and 55 both show Panama as still forming part of the Republic of Colombia, while on the latter the new boundary between the northern part of Bolivia and Brazil, according to the treaty of 1903, is not shown. These are defects that strike the eye at a glance, but other instances might be quoted, all tending to show that the atlas needs most thoroughly revising. For example, on the map of Switzerland, there is no indication of the Simplon tunnel, or of the railway extension to its entrances. On many of the maps, such as Asia and Northern India, the representation of the mountain systems and general relief is very imperfect, doubtless owing partly to the fact that the plates are much worn, having been subjected to many corrections and alterations. Notwithstanding all the interest that has lately been shown in the Antarctic Regions, and the fresh discoveries that have resulted from the numerous recent expeditions, there is no South Polar map. It is clear that if this atlas is to maintain the leading position it has held in the past in the geographical world, it must be thoroughly overhauled, and where necessary, new maps added. It would also be well, in a future edition, to add a few physical maps.

No. *North Pacific Ocean.*

284 Plans of anchorages on the west side of Saghalin island. 1905.
Presented by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

World. **U.S. Hydrographic Office.**

Chart of the World on Mercator's Projection, showing submarine cables and connections, and also tracks for full-powered steam vessels. Washington: U.S. Hydrographic Office. Supplement to the *National Geographic Magazine* for February, 1905.

This chart appears as a supplement to the *National Geographic Magazine* for February last. It is a new edition of that noticed in the *Geographical Journal* for August, 1902. The tracks of full-powered steam vessels, with the distances, are shown in blue, and the telegraph cables in red. Tables of distances between ports are also given.

PHOTOGRAPHS.

Cullinan Diamond. **Melvill.**

Twelve photographs of the Cullinan Diamond, 3024¾ carats weight, the largest in the world, and of a smaller diamond weighing 334 carats found in the Premier mine, Transvaal, taken by E. H. V. Melvill, Esq. *Presented by E. H. V. Melvill, Esq.*

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Zweite Reihe, Heft 8. Vegetationstypen aus der Kolonie Eritrea. Von Prof. Dr. G. Schweinfurth. Der Text nach den Aufzeichnungen G. Schweinfurth's bearbeitet von Dr. Ludwig Diels. Jena: Gustav Fischer, 1905.

West Africa. **Smith.**

Fifty-four photographs of Sierra Leone and French Guinea, taken by Canon F. C. Smith, M.A. *Presented by Canon F. C. Smith, M.A.*

Canon Smith has had special opportunity for photographing in the interior of Sierra Leone and adjacent regions. The photographs of natives and dances of the "Bundu," or devil women, are specially interesting.

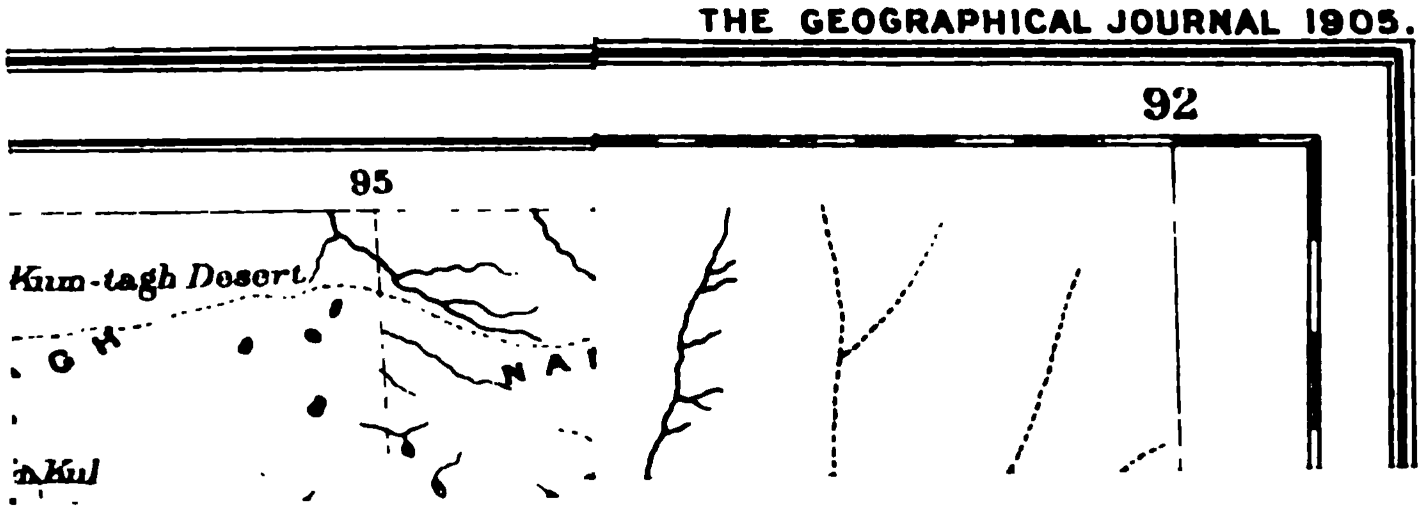
Sierra Leone:—(1) Freetown; (2) The railway station, Freetown; (3) Main street, Freetown; (4) The lighthouse, Freetown; (5) The cathedral, Freetown; (6) Freetown, showing St. George's cathedral; (7) Typical street scene, Freetown; (8) The hills behind Freetown; (9) The Atlantic breaking on the shore near Freetown; (10) Looking from the sea into Freetown harbour; (11) A view at Kent; (12 and 13) The hills of Kent; (14) The Sulima river at Bandajuma; (15) A chief at Bandajuma; (16) Palms, Great Skarcies river; (17) A young cotton tree; (18) A typical village; (19) A hedge of cactus, Banana islands; (20 and 21) "Bundu," or devil women; (22) Devil women dancing; (23 and 24) Mano; (25) Group of children, Mano; (26) The river at Mano; (27) Typical village scene, Mano; (28 and 29) A typical sailing canoe; (30) Some of Mrs. F. C. Smith's admirers; (31) Being carried by hammock in the bush; (32) Mrs. F. C. Smith and a Mendi chieftess; (33) Typical village showing framework of house; (34) Landing-place, Banana islands; (35) Crossing a river; (36) Madam Yoko, a celebrated native queen; (37) The retinue of Madam Yoko; (38) A woman making thread; (39) Mrs. F. C. Smith and the queen of the district; (40) Avenue in Bishop's court. French Guinea:—(41) Kapparroo; (42) Konakry; (43) Constructing the new railway station at Konakry; (44–46) The Rio Pongo; (47) Sunrise at the mouth of the Rio Pongo; (48 and 49) A hunting party; (50 and 51) Dubreka; (52 and 53) Isles de Los; (54) A tornado, Isles de Los.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

EXPEDITION TO LHASA.

YOUNGHUSBAND.

THE GEOGRAPHICAL JOURNAL 1905.



The

Geographical Journal.

No. 6. JUNE, 1905. Vol. XXV.

THE PROBLEM OF THE UPPER YANG-TZE PROVINCES AND THEIR COMMUNICATIONS.*

By Lieut.-Colonel C. C. MANIFOLD, I.M.S.

In an address which I had the honour of delivering before the Fellows of this Society eighteen months ago, I dealt with journeys of exploration made to the upper Yang-tze provinces in 1900 and 1901–2, in which we started in the one instance from Burma, and examined the approaches into Se-chuan from its western side, and in the other, coming down from the Yellow river, we examined the watershed between the upper waters of the Han river and the Se-chuan basin.

Se-chuan is not only the largest, but is the most wealthy of all the eighteen provinces of China. It has a total area of 181,000 square miles, of which 80,000 square miles, comprising the eastern and central portions, are occupied by the Red Basin formation, which supports a population of nearly fifty millions, the Chinese census giving even a higher figure.

To-night I propose to deal briefly with a journey made during the past year of 1904, in which the approaches from the lower Yang-tze provinces or eastern side of Se-chuan were examined, together with a large portion of the Han river valley and the watershed country between the latter and the eastern Se-chuan basin, a region about which little has hitherto been known to Europeans, and which, together with much of the country to the north and south of the Yang-tze, above Ichang, was for the first time accurately mapped. The importance of these regions lies in the fact that they might possibly afford a route by which the problem of opening up proper communications between the rich province of Se-chuan and the outer world might be solved.

* Read at the Royal Geographical Society, April 10, 1905. Map, p. 700.

The only means of communication which at present exist are those afforded by the Yang-tze river, which unfortunately, at Ichang, 1000 miles from the ocean, and whilst still some hundreds of miles short of the principal Se-chuan ports, ceases to be the fine waterway for commerce it has up to this point proved.

Above Ichang the river becomes wholly unsuited to steam navigation for the purposes of trade, and, under the existing limitations of steam power, it is unlikely that it will ever become a through channel of communication for steamships other than gunboats at fitful intervals. Merchandise at present can only reach Se-chuan after a protracted and perilous journey in junks, which often covers months, and in some seasons cannot be undertaken at all. The waterway failing as a means of communication, attention has naturally been turned to the facilities which a railway would afford in linking up this rich and populous province of Se-chuan with an ocean port, or a river port accessible to steamships.

The province of Yunnan and its approaches, through which connection might be made from the Indian ocean or gulf of Tong-king to Se-chuan, has been most carefully mapped and reported on by British and by French explorers, and, thanks largely to the surveys of Major H. R. Davies of the Oxford Light Infantry, there is now little of Yunnan which is not thoroughly known to us.

There is no doubt but that eventually Se-chuan will be tapped from the Yun-nan side, but this, on account of the difficulties which the route presents, is a matter which can only be slowly accomplished, but as I propose to allude to this question later on, I will not dwell on it further now.

In these days of rapid progress, commercial enterprise is not likely to let one of the Earth's richest regions, with a prosperous population ready to trade and numbering fifty millions or more, to remain cut off from its reach; so that, the Yun-nan route not being immediately available, the efforts of those nations interested in Se-chuan and its trade have been for some time turned towards finding a practicable route from another side.

Accordingly, in 1900, the late Captain Watts-Jones, who had already done much good work in Yunnan, and whose untimely end in his last journey must ever be deplored by those interested in this problem, made a journey from the neighbourhood of the Tung-ting lake in Hu-nan to Fu-cho on the Yang-tze, in Se-chuan. His report is one full of interest, but he was forced to confess that he could see no prospect of establishing railway communication between Hu-nan and Se-chuan.

In 1901–2, after the "Boxer" outbreak, I was sent in charge of a party, consisting of Captain Hunter, R.E., and two surveyors, to explore the approaches from the upper waters of the Han river into Se-chuan; and Captain Hunter, on the return journey, examined a route to the

south of the Yang-tze into Hu-peh, and at the same time was enabled to form a very good idea of the nature of the country which lay between his and Watts-Jones's route.

In this exploration of 1901–2 we did not follow the route up the Han river from Hankau, by which, under ordinary circumstances, its head-waters would have been reached, but we travelled from the Yellow river across the Chin-ling ranges, so that though, in the course of our journey,

A STREAM NEAR TA NING HSIEN WHICH DISAPPEARED INTO A HOLE.

the upper part of the Han river basin was mapped, and much knowledge of it was gained, yet the country drained by it and its affluents between Tzu-yang and Hsiang-yang-Fu, a distance along the river of about 400 miles was unsurveyed, and all the country to the south away from the actual river-banks remained quite unknown.

Up to Hsiang-yang-Fu, which is 300 miles from its junction with the Yang-tze, the Han river has been fully reported on by Captain McSwiney and Mr. Currie, who were members of the large survey party which, under the command of Mr. J. G. H. Glass, C.I.E., carried extensive survey operations in 1899 in Honan, Shansi, and [illegible]

It was largely due to the grasp then obtained by Mr. Glass of the problems affecting British interests in China, and to his foresight, that the present operations were undertaken ; and the support and encouragement of Sir Ernest Satow, which has always been so readily afforded to all projects of exploration, enabled the necessary preliminaries to be successfully carried out, so that in January, 1904, I found myself again in China in charge of a party which was to examine the eastern approaches into Se-chuan, including this unsurveyed portion of the Han river basin. It consisted of Captain E. Barnardiston, R.E., Captain E. Mahon, R.E., Mr. C. G. Nix, and five Indian surveyors.

From Shanghai we proceeded to Hankau by river steamer. There are seven lines running down between these places, three British, one Japanese, one French, one German, and one Chinese. Even at the season of low water, which was that of our voyage, these steamers can carry 2000 tons of cargo while they draw 7 feet of water up to Hankau.

We had on board a Chinese gentleman in the Bureau of Imperial Railways. He was on his way to Kiangsu to see about machinery for coal-mines there; the coal was brought up to the iron foundries opposite Hankau, where over one thousand workmen are employed.

A small local railway, which is being made in connection with these collieries to connect them with the Yuan river, is entirely under Chinese control and management. I was told of another small railway near Amoy, which has been made entirely by the Chinese, and the locomotives for which have been made in the Tong-shan workshops. The latter, under Mr. Kinder's management, will, it is said, soon be able to supply all the locomotives which China will require on the Chinese Imperial Railways.

All these are signs of the wonderful age of progress which is setting in in China, and of the advance which is being made by the Chinese themselves, though as yet only in a small way.

At Hankau we made a few days' halt to organize, and we prepared our plan of exploration, so that we should, by dividing into small parties, be able to cover as much ground as possible. I, with the main party, worked up to Hsiang-Yang-Fu *viâ* the large cities of Te-an and Sui-cho, whilst Captain Mahon, with two surveyors, went up to Sin-yang by railway, and thence worked to Hsiang-Yang-Fu. Thence he was to continue to follow, *viâ* Fang-Cheng, the overland route to Hing-an-Fu on the Han river. And whilst Captain Barnardiston was to survey along the main valley of the Han river to the last-named city, Mr. Nix and I worked up the valley of the Ton-Ho, a large affluent which enters the Han river a little above Yun-yang Fu.

On leaving Hankau, our party travelled for about 100 miles by the Peking-Hankau railway before we branched off from it in a north-west direction. This line has so often been described that it is hardly worth

while dwelling on it here, beyond pointing out that passengers can now book on it right through from Peking to the Yang-tze with only one interruption at the Yellow river, which is still unbridged, and is likely to remain so for some years yet, as the bridging of it will be a very big undertaking.

The Chinese have taken readily to this line as a means of transport for themselves and their merchandise, and it has begun to make profits already. It is entirely in continental hands; the higher staff is recruited from France and Belgium; the rolling stock and workshops and plant are supplied from these countries. Its terminus is in the French settlement at Hankau, and it is a great centre for continental influence throughout Central China.

This railway is to be prolonged another 1000 miles to Canton, and it seems very probable under the same Continental influences, unless the Americans, who at present hold the control, take steps to ensure its retention in their hands.

Our route took us through a part of Hu-peh which at first showed no great signs of wealth, the villages appearing poverty-stricken, with little of the solid comfort one sees either in the north or in Se-chuan. Every night we halted at whatever village we arrived at by dusk. But though the accommodation was of the scantiest and barest, we found the people most friendly and desirous of making our path as smooth as possible. I have never in any part of China suffered less from disagreeableness and annoying inquisitiveness than in this part of Hu-peh. I should certainly place its people first for amiability and good feeling towards foreigners.

As we approached the large city of Sui-cho, we began to come on greater signs of prosperity. The plain of Sui-cho is as densely populated as any part of China, and a great trade in locally manufactured cloth is carried on from its neighbourhood and sent all over the country. The only transport used, until the railway or a navigable affluent of the Han river is reached, is the wheelbarrow.

There is no doubt but that a good cart-road could be easily made; but whether it is due to the fact that draught-animals are not bred in any numbers, or that from time immemorial wheelbarrows have been used, these latter alone hold the field, and no attempt has been made to construct roads suitable for any other form of wheeled vehicle. In fact, where the route goes over country along which, if very little was done to the road, carts could travel, the streams are either unbridged and crossed by ferries, or are crossed by single spans of stone which admit of nothing wider than a wheelbarrow. These wheelbarrows, however, are by no means to be despised as a means of transport. Hundreds of them were passed by us, each loaded with at least five and often seven or eight of the bales of narrow cotton-cloth made in the [illegible] districts, each of these bales weighing about 17 lbs. [illegible]

One man would wheel a barrow carrying 350 lbs. and make his 12 to 20 miles a day, more than double the amount which the Government pack-mule is allowed to carry in India; and the same human beast of burden will go on making the journey cheerfully day in and day out, without any halts for lameness or sore backs.

My admiration for the Chinese coolie is unbounded; there is no man in the world who does the same patient, laborious work so cheerfully.

Further on, when we came to the mountainous watershed country, where only back-loads are possible, I became still more confirmed in this opinion. Often after a long and weary day with the surveyors, in the course of which we would have climbed up from 5000 to 8000 feet, and made several such ascents and descents, having, perhaps, been on the move from five in the morning until dusk, we would come in, rather inclined to pat ourselves on the back at the thought of what a hard day's work we had successfully accomplished, only to find that the Chinese coolies had made as good time, each man having covered nearly as much ground with a load of 100 lbs. on his back. This done on a few bowls of rice and bean-curd, for a wage of less than 9*d.*

And then, on their arrival, one might have thought that the coolies would have been glad to get to rest; but if, as was often the case where accommodation was limited, I slept in the same house, I found to my annoyance that to retire to bed was far from their thoughts, and that my sleep was often disturbed by the noise they made, as they sat up gambling long past midnight; and yet they would be again on the road before six in the morning, having risen to make up their loads and get their food cooked before five, though I must say that to effect this early start necessitated considerable supervision and early rising on our part, and on that of the Fu-tou, or headman of the gang.

Lao-ho-ku, our first halting-place, is the most important trading centre on the Han river above Hankau, and is well situated, with a river frontage of 2¾ miles, giving very good wharf accommodation. Its importance consists in its being at the head of navigation for large junks from Hankau. At Lao-ho-ku the cargoes these junks bring up have to be transhipped into smaller boats, if going up the Han river to southern Shen-si, and also if going up the small tributary to King-tze-kuan; from the latter place it is by mule and camel to Hsian-Fu, the capital of Shen-si, and to Kan-suh.

Goods take from fourteen to twenty-eight days coming up the 300 miles from Hankau. The average depth of water is about 3½ feet, but at low water it is difficult to draw more than 22 inches in the rapids. Boats carrying 20 tons get up to Lao-ho-ku without, as a rule, having to lighten cargo.

It is very unlikely that the Han river will ever lend itself to successful steam navigation for more than 100 miles above Hankau, except in a most favourable state of water. In February we tried to

get a steam-launch at Hankau to take us up quickly, but found that it could not guarantee to go up more than 40 miles in the existing state of water. Goods are distributed from Lao-ho-ku *viâ* Teng-chou to the great northern road into Central China, though the Peking-Hankau railway must now take away a great deal of this traffic from the river.

The six large wholesale firms who deal in foreign cottons here are said to do a business of 10,000,000 taels a year, and there are a number of smaller firms transacting at least an equal amount. There is an enormous trade done in varnish oil, which goes greatly to Japan. There is an immense general trade in every sort of goods. The mer-

SE-CHUAN RIVER BANKS.

chants are mostly from Southern China, are very prosperous, and have splendid guildhalls in the town.

News of the early Japanese victories had reached the place. The inhabitants were strongly pro-Japanese, but were amazed at what the Japanese had accomplished, and said it was no wonder that China had failed to fight them successfully.

The anxiety evinced by the Chinese authorities to avoid any chance of embroiling themselves with foreign nations from any ebullition of excitement on the part of the populace on the outbreak of the war was very marked. Everywhere we went we found proclamations posted by the local authorities to the effect that all subjects of the emperor were expected to behave with the utmost circumspection towards foreigners

in consequénce of the troubled times, and that any insult or disrespect to foreign missionaries and travellers would be severely dealt with.

A large building was being erected in Lao-ho-ku, in which the pursuit of Western learning was to be carried on. It was nearly completed, and had doors and windows made in foreign fashion; but, as we found later on in all the places we visited, there was no one in the city capable of imparting instruction.

After Lao-ho-ku, the next place of interest we struck on the Han river was Chun Cho. This is one of the most interesting old places in China, and is entirely different from most cities in which I have been. It is said to have more temples than any city in China, and the foundation of its sanctity to have originated from the time of Cheng-tsu, the third emperor of the Ming dynasty. Its proximity to the sacred mountain of Wu-tai Shan accounts, to a great extent, for its peculiar old-world monastic atmosphere. It is a most delightful sleepy old place, with quite the air of a cathedral city, with its precincts full of votaries, who, on their way to Wu-tai Shan, stop to worship in its temples. It was founded in the Yuen dynasty, but was entirely rebuilt during the Ming dynasty in the reign of Hung-wu. It was early in this dynasty that Peking became the capital under the following circumstances: The second emperor, Hwei-ti, was travelling in the southern part of his empire, when his uncle, Cheng-tsu, improved the opportunity of his absence to raise troops and seize the capital city, Nan-king, and soon after he established his capital at Peking. In spite, however, of his dishonourable conduct towards his nephew, he had a great inclination towards piety, which became so intense that he aspired to become a saint, and most of his time was spent in reciting prayers and doing meritorious acts, in order that he might secure indulgence for his previous misdeeds. Amongst other acts of piety, he used to maintain in his palace thousands of Taoist priests. At last, in a vision, a heavenly deity appeared to him, commanding him that he must avail himself of the first opportunity to do some heavenly work in order to secure the favour of God and to avert his punishment. The deity had the same features as Cheng-tsu. The emperor's flatterers accordingly suggested to him that nothing could be more pleasing to Heaven than to erect a temple, in which a resemblance of this deity should be placed. And soon after this, when visiting the sacred mountain of Wu-tai Shan, he saw beautifully coloured clouds descending from the sky on to Chun Cho, in which place he accordingly built a large temple, and placed therein an image of his celestial visitor, which was modelled on his own likeness, and is to be seen still.

Yun-yang, the next city we came to, is a large city on the left bank of the Han, and is somewhat of a military centre, being the headquarters of the chen-tai, or brigadier-general of the district. This officer was a very fine old warrior of the old school, and had seen fierce fighting against

the Panthay and Kan-suh rebels; his body was covered from head to foot with wounds, and of these he had nearly one hundred, and I almost suspect that at some time he must have been taken prisoner and only saved from death after he had been tortured, though his own history of his wounds by no means tallied with this. From his account, nearly each one had been received in some separate fierce hand-to-hand encounter. He had the fine hearty bearing and manner of the old school, which one finds amongst Chinese veterans of standing and rank. I always like them; they have a bluff geniality and outspokenness one seldom finds in the civil official in China. As a rule, even though their ignorance of foreign methods may be greater than that of the latter, the high military officials are in favour of reform; they see how China has lost all her military power and prestige, and they are anxious for her to regain it, and they recognize that in the existing state of affairs there is no hope for this.

I was so fortunate as to have travelling with me just at this time the Rev. Gilbert Reid, who has had a great experience of dealing with the official classes of China, and who has, in late years, lectured a great deal to the Chinese in various large centres on such subjects as their relations to foreign powers, etc. It was very interesting to find in several of these out-of-the-world places up the Han river the officials at once recognized his name, and had read his lectures in the Chinese vernacular papers issued from Shanghai. At Yun Yang Fu the Taotai, who had been here for twenty years, and was very evidently a man of the old conservative school, referred to his having heard of them and being much interested. This was a great admission for a man like this to make, and showed that there is a great under-current setting in towards reform and a wish for enlightenment. Yun Yang Fu has always borne a bad reputation for its attitude towards foreigners, the latter have several times been expelled by the inhabitants, and it was distinctly one of the most backward cities we came across. However, under the Imperial edict ordering research after Western knowledge, a large building has been set aside as a school for foreign learning to be taught in, although, as in nearly every other place we visited, we found no further progress than this had been made on account of the dearth of qualified teachers.

From Yun Yang Fu I struck into the country south of the Han river, following up the valley of the Ton Ho. These regions between the Han river and the Yang-tze are a mass of mountain ranges, which, considering their barren and sterile appearance, have a wonderfully large population in their small valleys, the latter being under the most careful system of cultivation.

In fact, the population is greater than these tiny little valleys and crevices, containing patches of cultivation almost hidden away from sight, can support, and a large quantity of grain is imported in return

for paper exported, of which great quantities are manufactured. There is also a large export of straw for shoes, which grows all over the hill-sides, as does also rhœa and trees producing Tung oil, and Chi yu varnish, the latter used for oiling umbrellas and oiling waterproof paper, all of which products are exported in considerable quantities, and, where water-transport is available, coal; the mines from which the latter is extracted are near Chu-shan. The rivers, however, are not of much avail. Junks carrying 3 tons can get up the Ton Ho as far as Chu-shan. In low water the rapids present difficulties, and in high water the current is too swift for any greater freights.

I followed up the Ton-ho valley as far as Chu-shan, where I met Captain Mahon, and thence travelled along the overland trade route to Hing-an-Fu, on the Han river. All these valleys are full of coal, and there are great rumours of evidences of copper and silver in paying quantities, and a great deal of attention has lately been paid to this part of China by continental mining engineers.

Some six weeks before our visit two French engineers had been here, and ten months before that a party of three had also visited this place, and since our visit I have been informed that separate parties of Belgian, American, and French engineers have visited these districts. It is to be hoped that those interested in British mining enterprises in China will also investigate into the prospects which these regions may hold out, for there appears to be little doubt but that the prospects of mineral wealth are worthy of their attention, and should the reports of its richness be verified, and the amount of traffic that is likely to arise warrant such an undertaking, the country between Lao-ho-ku and Chu-shan would afford a practicable alignment for a railway line.

There is a very curious tradition about diamonds having at one time been found in these regions and in those of the Chin-ling range, on the north side of the Han, and at Lao-ho-ku we were told that there were families who still had in their possession as heirlooms diamonds which in old days are supposed to have come from these parts, but from what locality is no longer known. A year or two ago one of these men took two of these stones, which had been in his family for generations, to Shanghai, and received 7000 taels for them. We, however, had not the good fortune to find any of these lost diamond mines, and my idea is that the story of their existence in old times may be rather a mythical one.

Hing-an-Fu, which we next made for, is the first large city on the Han, in the province of Shen-si. The present city is on the right bank of the river, on a large flat formed by the old bed of the Han, which has changed its course. The former city, which was in existence before the Tang dynasty, was situated on the left bank.

The Tai-ping rebels carried Hing-an-Fu by assault, and massacred one-half of the population on their way to Han-chung-Fu. There is a

large Mohammedan element in the city, nearly two thousand. They are very easily distinguished, as they have a more swarthy appearance and more marked features than the Chinese.

Mr. Burgess, of the China Inland Mission, who has been here for many years, told me that they often give trouble, as they are very quarrelsome, much given to boasting of their Turkestan origin, and, in spite of the Prophet's injunctions, drink a great deal of wine. This is usually the case with Chinese Mohammedans. Here, and more especially

PAVED ROAD NEAR CHENG-TU.

in Kan-suh, a few of their spiritual teachers keep up their knowledge of Arabic, and are occasionally visited by Arab or Central Asian mullahs, who follow the old Arab trade route by way of Hami, by which the Arabs originally traded and propagated their faith. These mullahs visit every country in the East where the followers of the Prophet are to be found, and keep up the ties of the faithful with Islam. As they often stir up dissatisfaction and foment disturbances against the Chinese authorities, the latter regard them with suspicion, and they

are given short shrift under these circumstances, and are not heard of again. I was told of one of these mullahs who lately in Lan-chon, in Kan-suh, had been seized on in this way, and his co-religionists, fearing his fate was sealed, came to the English mission station and appealed for assistance on the ground that he was a British subject. With some difficulty an interview was obtained, but it was found he spoke no Chinese, only Arabic, but he kept repeating in English the words "Bombay, Calcutta, King Edward," evidently the whole of his English vocabulary, but whose importance in establishing his claim to be a citizen of no mean empire, and of being a subject of the great Kaiser i Hind, whose name even here could protect him, he thoroughly realized. I am glad to say that the magic words enabled him to escape the fate he would doubtless have otherwise suffered.

In spite of the mountainous character of the country around, rice, wheat, oats, barley, beans, and peas are abundant, though opium has taken up much of the good land formerly occupied by wheat and rice. Seven years ago rice is said to have been sold at 8*d.* a bushel, now it is about 2*s.* 8*d.* per bushel. The export of mountain produce is large, and that of a species of mushroom called Erh-tsu, which has reputed qualities of much virtue, is said to amount to 100,000 taels. Hemp to the same value is also exported, and a similar amount of tea. Also ki, or lacquer varnish, is exported in large quantities. An immense quantity of tong yu, or tree-oil, is also exported from the districts around; scores of mills are at work expressing it. There is a large trade done in hides by the Moslem merchants, who ship these down to Hankau. Medicine, opium, and silk are also exported in large quantities. Coal is supplied to all the cities down river, and tons of grass rope and grass sandals are sent up and down river. Most of this trade from Hing-an-Fu goes direct to Lao-ho-ku or Hankau. With high water a junk will travel to Lao-ho-ku in five or six days; eight days is about an average run, and twenty to Hankau. A quick run up from Lao-ho-ku is fourteen to sixteen days. Although, when travelling through the mountain country to the south of this portion of the Han river, one had been surprised that it could support so much population, and that the latter could afford to import food-stuffs, yet when one appreciated the amount of exports collected from similar country around Hing-an Fu and sent down, one quite realized how the imports were easily paid for. That these exports largely exceed the imports is shown by the fact that numerous mao-pan, or cargo boats, are hastily put together to carry cargo as far as Hankau, and on arrival there are broken up and sold as lumber.

The attitude of the people here is not very cordial to foreigners. Friction with Roman Catholic converts has had something to do with this, and in consequence of disturbances which occurred shortly before our arrival, between the latter and a secret society called the River

and Lake Society, troops were called out, and about sixty people were shot down. This episode has by no means lessened the unfavourable feelings with which the Roman Catholic community are regarded.

The country we had so far travelled through for the 300 miles since we had left Chun Cho had proved most mountainous. There is no such feature as any valley, in the sense of valley-bottom land, to the Han river in this part of its course. The river lies between steep hillsides, which often for miles are converted into the precipitous

ANCIENT TABLETS AT CHUN CHO.

walls of gorges, and, except at rare intervals, where an affluent comes in and has formed a small plain of perhaps a couple of miles in breadth, there is no level ground.

The basin of its large affluent the Tou Ho, whose headwaters drain most of the country between the Han river and the Hu-peh portion of the Yang-tze above Ichang, also presents hardly any open country. Little more than a sea of confined ranges can be seen to the south of the Han, and no open valleys run for any distance. Between the Se-chuan

basin affluents and the Han river lie barriers of even more intricate and more barren mountain ranges, which we now proceeded to traverse. At any time these produce barely enough to supply a very scanty population, but three years of scarcity had preceded the present one, so that in these regions we found that we had to carry everything in the way of food for our party, even rice for the coolies. The country people, we found, were in many places subsisting on roots and grass-seeds. We were now in the heart of the Ta-pa-shan ranges which form the north-east boundary of Se-chuan. We have already seen how much difficult mountainous country must be traversed before even this barrier is reached, but when the difficulties of finding a suitable road through this are surmounted, and the hope arises that now only a single dividing range cuts off the Se-chuan basin, it is found that the chief difficulties of the route have still to be overcome before the actual water-parting can be negotiated. For from the main divide are thrown off numerous large offshoots, which often for a long distance run nearly parallel with the latter, forming secondary watersheds, to surmount which is in itself a very difficult task. For an alignment could not be carried along the sides of the tortuous streams which wind their way between the precipitous sharply interlocking spurs of these secondary ranges; and having overcome the difficulties offered by the first or even the second of the latter, it is only to find that there is still another to be crossed, and yet another, before the main divide is attained. These Ta-pa-shan ranges are largely composed of limestone, which is worn away into all sorts of fantastic shapes, whilst sheer-cut precipitous white cliffs, beautifully wooded at their summits, rise majestically above the stream-beds some 1000 feet or more. These streams are for the most part dry, and their beds are full of the most enormous boulders, 10 and 12 feet high, which are carried down into them by the torrential rains, and lie in such numbers so close together, that the coolies who use the stream-beds as routes in the dry season, have cut ladder-like holes in them for their feet, such as might be made to clamber over a wall that stood in the way. Our progress under these circumstances was often slow, and I remember a path of this sort along one stream-bed over which, even without any encumbrances, my guide and myself took four hours to make a distance of 3 miles, whilst our coolies took more than double the time. A peculiarity of this country is the extraordinary way in which streams of good size entirely disappear; they have eaten their way into the limestone by an underground tunnel, and may be found again appearing many miles away. Another feature is that high up there is a great deal of easy valley at the sides of the streams, but as the descent is made, these valleys, instead of opening out further, become more and more contracted until at last they plunge into the most magnificent gorges, hopeless for all purposes of communication.

The Se-chuan side of the watershed affords a more gentle incline towards the northern end of the watershed, but further south, after a high tableland is traversed, there is a sudden plunge down some thousands of feet in a few miles.

After leaving this country, our party proceeded to examine the country immediately south of the Yang-tze and also the eastern corner of Se-chuan, a part of the province hitherto hardly touched on by Europeans; at least, only in one place did we hear of Europeans having previously been seen, and here we were told that thirty years before a party of five or six foreigners had passed through. The only clue we could get as to their nationality was given us by an old man, who, catching sight of rather a loud and gaudy check-pattern of the lining of a mackintosh, said they had all worn clothing of a similar pattern. It seemed to be rather an out-of-the-way part for the British tripper to have penetrated, but I think the evidence pointed to the nationality being British. The people in these places were very pleasant to deal with, and though at first afraid, when once accustomed to our presence, always exhibited a marked kindliness and a desire to make the rough shelters they offered us as agreeable as possible. I was much struck, after my wife had joined me in this mountainous region, by an incident which occurred in a little hamlet where we had put up for the night, and torrents of rain were coming down. We had had assigned for our accommodation what was said to be the best of the half-dozen hovels which composed the hamlet, but as the rain came through the roof on to our bedding in streams, I hunted around for a more watertight house, but was received with the most unwelcome looks, and could not make any arrangement with the owners, and had to abandon the attempt to improve our condition. To my surprise, a few minutes after, we received a smiling deputation of the very householders who had given us such surly looks before. They said that they had since heard that my wife was with the party, and was suffering discomfort, and they hoped we would honour their house, and that their womenfolk were most anxious she should have their best room, and had already made it ready for her occupation. I thought it was a most kindly attention, as it was evidently done out of pure kindliness, and a wish to make things easier for the foreign lady. It is not a country, however, that I can recommend to ladies here to travel in at any time of year, but least of all when the rains are in full vigour. In the next day's march our experience was even worse, as towards the evening we came upon an unbridged torrent in flood; the only ferry-boat had been carried away, and the only accommodation lay on the other side of the river, with the exception of a salt-coolie's inn, which consisted of two rooms built of planks with inter-spaces of 6 inches or more, and which were grimed with the dirt and smoke of generations of salt-coolies, of whom there were already about twenty in possession. On this occasion we were fortunate enough to

find an old half-ruined Taoist temple to take shelter in. In China it is impossible to use tents, as the traveller, even in an inn, has to close his doors to keep the mob out, but in a tent his life would be unendurable owing to their inquisitiveness. I have had my tent carried off its poles by the pressure of a well-meaning but curious crowd.

Trying as the rains are, they cause the temperature to drop so that one can march with comparative comfort; but later on in July, when there was a long break, the heat marching in the day became most trying to all, and in one march, though only carrying light loads, three coolies dropped down from sunstroke.

The inhabitants of some of these places held some very quaint superstitions. For a long series of marches going through this country we could get no fowls, a great privation in this part of China where no meat is obtainable; we were told that some time before a fowl had scratched a man, and he had died from the effects. A story got about that a dragon had got into the poultry, and they were liable to cause death to their owners. Throughout all the neighbouring districts all the poultry were slaughtered as the story spread, and we had to pay fabulous sums when we came across any, and these were, of course, now in great demand for rearing purposes.

Further on we left the mountain fringe for good, and plunged into the Se-chuan basin. A great deal of this eastern portion has as yet been rarely visited and described. It is probably as rich and densely populated as any part outside the plain of Cheng-tu. Splendid coal is to be found everywhere, and the gunboats who now use it instead of bringing Cardiff coal, which, when imported up the Yang-tze to Chung-king, costs about 120 shillings a ton, say it has a great steaming power. Iron is also found everywhere, but the iron foundries are most primitive. And there is a great prospect of profits before any English firm who will import hoes and other agricultural implements suited to the wants of the people, as there is an enormous demand for these.

As we dropped down on the Se-chuan side of the watershed, we found the gorges were most magnificent, far finer than any of the far-famed Yang-tze gorges. I have never seen anything to equal the grandeur of some of the scenery in these parts.

What enhanced this was the fact that one often approached these gorges from a point where the mountains had opened out for some distance, and a much better panoramic effect was obtained than if one had been buried in the depths of the gorge, as is nearly always the case on the Yang-tze.

Never shall I forget the impression produced as we approached one of these places where brine wells were situated at the entrance to a gorge of the most extraordinary grandeur, and the houses in which the process of salt manufacture was carried on were built on ledges up the steep hillsides. We were coming round a winding path on the open mountain-

side, when it suddenly appeared in front of us, its mighty cliffs rearing themselves up to the sky from the huge black chasm down below. The quaint temples and houses which were built up the steep hillside, which latter appeared very little less precipitous than the cliffs of the gorge, were shrouded in pillars of thick black smoke from the salt brine furnaces, and through a sort of haze the glow of the evening sun threw the blackness of these into still greater relief against the impressive gigantic cliffs. The whole scene gave one the impression that some weird race of giants, who belonged to some other age, had retained their hold on some portion of a former world, of which this was a corner.

BRIDGE AT WANHSIEN

Altogether this watershed country possesses the most wonderful scenery which could be found anywhere, for further on, as we plunged into the cultivated hills fringing the basin of Se-chuan, we came on miles of wide sloping hillsides with summits rolling well back, covered for miles as far as the eye can reach with myriads of tung trees, which in this spring season were in their full delicate blossom of waxen, faintly tinged petals, whilst down below in the valley lands is poppy for miles and miles in bloom—one valley with nothing but perhaps scarlet flowers, the next all purple, and the next white. Nothing could be more lovely. I foresee the time when these borders of Se-chuan shall have easy access to them established, and may become a resort for

the sightseer seeking beauty to as great an extent as the Japanese scenery is sought at present, and when the inhabitant of Se-chuan may treat him to as cordial a welcome as the wealth-bearing foreigner receives in Japan.

It must not be thought that all the basin has the same charm as this. It is only this wild mountain watershed and the fringe immediately between it and the more cultivated Se-chuan basin scenery that has the wild charm and beauty. The basin itself though very beautiful soon palls on one from its regular cultivation and unvaried regularity of scenery.

We now came on populated parts and large district towns. Even in these out-of-the-way parts we found that a building had been set aside for the pursuit of foreign learning. But some further steps than this will have to be taken, and each district town throughout Se-chuan was sending three students to Japan at the expense of Provincial funds to be educated in foreign learning and modern science. I am afraid as they were only to go for a year that they would hardly acquire a very thorough insight. Japan will undoubtedly supply China with her college educational system and instructors in Western learning. Previous to the present war they had begun to supply the Chinese with military instructors, and three had been sent up to Cheng-tu, the capital of Ssu-chuan. The value the Japanese justly attached to the opening they had thereby effected, is, I think, well shown by the fact that in spite of the strain caused by the present war, which must have made them ill able to spare the services of a single officer, much less ones specially selected for their knowledge and capacity of organization, such as these men would have been, yet they had not been recalled.

That the Japanese will also supply nearly all the civil professors for the new civil colleges, there is also, I think, but little doubt. Apart from the fact that they are in much closer touch with the literature, foibles, and etiquette of the Chinese, and start with a knowledge of the written character which the imported European or American professor would take at least five years to acquire, there is no doubt but that the services of a Japanese professor can be obtained at a rate of salary which would not make it worth the while of a well-qualified European, who can probably obtain double or treble the salary in his own country, to go into exile for. And as China is at present a poor country, for this reason alone she will find that Japan is best suited to supply her wants. That Japan not only will send instructors who understand Chinese foibles and etiquette, and who will be able to adapt themselves to these when necessary, yet at the same time that she will insist upon being recognized on Western lines, was brought home to me by a trifling incident when, in company with Mr. Sly, our acting consul at Chungking, I called upon the Japanese consul there. As the latter spoke no English and we spoke no Japanese, Chinese was the language used as

an intermediary in which to carry on our conversation, and during the course of the latter, I happened to ask what were the ranks of the Japanese military instructors at Cheng-tu. There appeared to be some difficulty in the Chinese terms being fully comprehended, and an Anglo-Chinese book was produced, and opened at a page on which were the Chinese characters supposed by the distinguished sinologue who had compiled it best to represent the English ranks from full colonel to lieutenant, and which our authorities at Peking are in the habit of accepting as equivalents when issuing a passport to military officers.

The Japanese consul, however, expressed his disapproval after an explanation of their use had been given, and said that, though these terms were used in the Chinese army, none of these characters bore any proper relative significance to those used by foreign military powers, as the officers carrying such titles in the Chinese army had none of the responsibilities or status or consideration given even to a company officer in a European army; and hence the Japanese authorities did not make use of them as proper terms to denote the status of their officers. Turning over the page, he pointed out the characters accepted by the learned author as representing the equivalent for a brigadier-general, and said that, though this appeared to be rather a wide-reaching one for the purpose, it would be the lowest one he would care to use if he wished to convey any proper impression to the Chinese of the status which an officer in the Japanese army was accorded by the authorities of his own country. I think this incident will be appreciated by those British officials who, when travelling in China, may have found that they had been assigned the same status, and were enjoying in the eyes of the Chinese authorities the consideration and respect accorded the leader of the ragged guard, who, on seeing their baggage safely to the next town, would gratefully accept a couple of dollars' tip, the dignity he enjoyed being really little more than that of a corporal.

By June we reached Chung-ching, which city I was visiting for the third time within the past five years, and on each occasion I found it had increased greatly in prosperity. There is an immense trade to this river port, which trade could be increased to an enormous extent were better means of communication once established.

Chung-king is the commercial metropolis of Se-chuan, and the first objective of any railway entering the province must be this city. For it stands at a point on which the network of all the rivers of Se-chuan focus, and to which all their traffic is borne. And although, for commercial purposes, steamers are never likely to be able to navigate the Se-chuan waterways, not even the main stream of the Yang-tze, yet large junks carrying freight of twenty to fifty tons by sailing and tracking can navigate them for some hundreds of miles, and smaller junks

can reach to the confines of the Se-chuan basin, transhipment always taking place at Chung-ching.

Its present great import trade is in Indian cotton yarn, which constitutes over 70 per cent. of the total foreign imports, and even against the competition of the Shanghai and Japanese cotton mills, with their advantages of proximity and abundant labour, India has so far not only held her own, but within the last two years has doubled her imports, and has achieved this under the most harassing restrictions caused by the hazardous means of communication which at present exist.

These have engendered a still more hampering system of credit, the detrimental effects of which, on the purchasing powers of the Se-chuanese consumer, Mr. H. E. Sly, who was acting consul at the time of our visit, has shown most clearly in a recently published report, which will well repay the careful study of those interested in British trade in these parts. Mr. Sly shows how the peculiar system of dealing in merchandise now in existence is due to its delay in transit, and that thereby a great dearth of ready money in circulation amongst the people of the province is caused, hence the larger part of the trade has to be done in kind, and thus the actual value of the products is far greater than the producer himself obtains by their sale.

A railway will remedy this, as by the safety, and regularity, and celerity, and cheapness of transport it will provide, it will facilitate direct interchange, and so cause an increased import of foreign goods, which will come up in three days instead of as many months. Direct intercourse with the purchaser of these goods, who is the seller of his own, will largely divert the profits of barter from the hands of a few wealthy speculators, as at present, into those of the people themselves, and thereby increase their purchasing power, and from this a great increase of trade in British manufactures will result.

At present, of the £2,381,616 sterling of foreign imports which pass through the customs at Chung-ching, £2,150,000, or over 90 per cent., are represented by British textiles, and of these Indian cotton yarn accounts for £1,849,676 sterling.

These figures show the extent to which the Indian Government must be interested in all that pertains to the further development of such a market. It is difficult to place any limitation on the possibilities of expansion this trade alone offers under better conditions of transport. But apart from this cotton yarn trade, which India is peculiarly suited to supply, and in which she does not enter into any harmful competition with our home industries, there is an enormous field for these latter in Se-chuan. For as yet we have only been able to touch on the outskirts of the trade which the province is capable of affording. To Lancashire in cotton drills and shirtings, to Yorkshire in woollens, to Sheffield and Birmingham in machinery and metal work. As the resources of the

province and the purchasing powers of the inhabitants are developed by a railway, an immense trade will spring up in all of these articles. We have in Se-chuan an enormous population, larger than that of the British Islands, a population endowed with the highest intelligence, industry, and thrift, and eager to purchase everything which will add to their comfort and be of use, inhabiting a country rich in natural products, and only requiring to have its latent resources developed to become perhaps the richest in the world; a population requiring all the articles which these great manufacturing centres of ours are striving to find a market for, and are liable to be starved for want of; and a country in which our manufactures have effected such a footing that

THE TA-PA SHAN.

90 per cent of the existing trade belongs to the British Empire, and within the short period of ten years, under the most disadvantageous and hampering conditions, this trade has been able to treble itself, even whilst the latent wealth of the province and the purchasing power of the people has remained undeveloped, due to want of proper communications with the outer world.

In the Se-chuan basin, within an area not exceeding that of Belgium, and with a far greater population, there is not even a single road which will admit of wheeled carriage or of draught animals of any sort being used. In these days of severe industrial competition it seems almost incredible that a country with this enormous population and

natural advantages should have been allowed to remain without a railway, when even the local traffic from town to town would have been sufficient to make one pay. What, then, are the factors which can possibly stand in the way of such a profitable undertaking, and one so desirable to the world at large? It cannot any longer be said that the Chinese are prejudiced as a nation against any sort of railway construction being undertaken in their country, for we have just seen how this great Peking-Hankau line has sprung up and runs through the centre of the great plain of China, and is being eagerly resorted to by the people. And though we may well lament the small extent of British controlled railways in China as compared with those of continental nations, yet it cannot be said that British capital will not come forward. That it is in no way less enterprising than that of other nations may be seen if we look around at what has been done by it elsewhere in China where it has been able to secure an opening, as in the northern railway to Peking and Shan-hai-kuan, where it was the pioneer of railway enterprise on a large scale, and more recently in the Shanghai-Nanking line, whose value the public are now realizing, and also on the Shansi plateau, where, under great difficulties, 700 miles from an ocean port, it has constructed and is successfully running a line of railway connecting the immense Shansi coalfields with the waterways of the Grand Canal.

Neither active hostility on the part of the Chinese, nor want of British enterprise, can therefore be looked upon as the factors of hindering British commercial development in the upper Yang-tze provinces, but there are two obstacles standing in its way which should be carefully considered.

The first of these is, that the Chinese provincial authorities state that they are themselves desirous of undertaking all future railway construction, and of effecting this solely with Chinese capital raised in the provinces concerned, and wholly under Chinese management. Now, no one could in fairness possibly object to this programme being carried out, and as Se-chuan has interest for Great Britain only from the fact of the immense trade that it will one day give us, we as a nation ought to be delighted to see the Chinese themselves doing anything to open up the province in a way which will bring this about speedily. But in the keen modern competition for trade it is almost impossible for any manufacturing nation, least of all for Great Britain, to look on unconcernedly at the indefinite postponement of the development of one of the richest and most densely populated parts of the Earth's surface, a part of China whose trade we already possess so large a proportion of, but which represents only a small fraction of what it is capable of affording us under better communications and modern conditions, and it would appear as if such indefinite postponement is likely to be the only result of provincial action; for though the Chinese say that they

are about to raise six millions sterling in the Hu-peh and Se-chuan provinces for the construction of a railway which will pass through these provinces from Hankau to Cheng-tu, there is no doubt but that neither this sum, nor even any fraction of it worthy of consideration, will be forthcoming under existing conditions.

According to the official announcement which has been made, the railway is to be constructed and managed by the provincial officials, whilst the local magistrates, landholders, and merchants are to be invited to subscribe the money on a four per cent. guarantee, and no foreign assistance is to be accepted. Now, in Se-chuan the ordinary investor does not care to deposit his money even in safe security unless he obtains 12½ per cent. interest; and in China a railway whose financial control was in the hands of the provincial officials would hardly be looked upon as a desirable investment by the astute Chinese investor, who has had an experience of official methods. The necessary amount will therefore never be subscribed, even if six millions were sufficient, but, as a matter of fact, the sum required will be nearer ten millions sterling than six, if the railway is to be carried from Hankau *viâ* Chung-ching to Cheng-tu.

It is quite possible that by offering certain official privileges to investors a comparatively small sum may be raised, perhaps sufficient to keep up an imposing railway bureau in Cheng-tu, and for some time to provide high salaries for a few officials, and even to enable the preliminary survey of a small section of line being undertaken. But such steps as these will be considered by the local authorities to be sufficient, and may be pursued for years without any real progress being made, until the funds are expended and no result attained; and in the mean time the wealth of the province, which should afford such an immense market for our trade, will remain undeveloped. In these days of densely crowded industrial centres, whose populations must have markets for their products, the rest of the world cannot afford to be indifferent to a state of affairs resulting in such a deadlock.

It would be in the best interests, not only of the world at large, but also of China herself, if the Chinese imperial authorities were to fix a limit of time within which the provincial authorities must show evidence of being able to undertake construction, with some hope of the completion of the railway within a reasonable time, or, if not able to do so, that foreign capital should be invited to give the necessary aid. And as British trade represents over 90 per cent. of the foreign trade done in the upper Yang-tze regions, it should appear reasonable to the Chinese Government that when, as will inevitably be the case, foreign assistance is called to aid in the construction of a railway in these regions, British capital should have the preference given to it. But this brings us to the second of the obstacles which stand in the way of British commercial development in Se-chuan. We have with our neighbours the

French an agreement, of which, if a perverted use is made, either nation is likely to be hampered and obstructed in the execution of any enterprise which it endeavours to carry out single-handed in Western China. By it France and England are reciprocally forbidden from gaining any exclusive advantage, privilege, or monopoly in the provinces of Yunnan and Se-chuan. This agreement is one which, if interpreted on a mutual friendly basis, might lead to the most advantageous results accruing to either nation. Unfortunately, there has always been the possibility of international rivalry being so strong, that resort might only be made to an agreement originally intended to be beneficial, when by its instrumentality what are excellent intentions on the part of either nation might be frustrated and rendered null and void in results. Of late, however, between our neighbours and ourselves the promise of a happier era has set in, and we may hope to see the fruits in Western China, and as a contract under which either nation must not enjoy any exclusive advantage cannot be brushed aside to suit the convenience of only one, it becomes necessary, if any progress is to be made, that a *modus operandi* should be established, and as we are the people who will suffer most by any obstruction which will delay the development of the province and the increase of trade which we may legitimately expect to derive therefrom, the sooner we come to a mutual understanding, whilst not endangering any of our interests, the better it will be for these.

It would be preferable to see any railway development wholly British, but if we have to enter into joint co-operation with any nation in these regions, a combination with the French—who so far have not been a formidable rival in our particular industries—would appear to be the one which is likely to be least prejudicial to the interests of our manufacturers. France, with her genius for initiative, has always excelled in the conception of great designs, whereby the whole world has profited ; and Great Britain, with her vast commercial undertakings and constructive capacity, has supplied the flow of trade which these designs have required to bring them to fruition. As has been seen, the foreign trade which already exists in the upper Yang-tze regions is almost entirely British. It will be wise for us to consolidate and extend this before more formidable trading competitors than our French neighbours step in and secure a footing in these markets to the detriment of our own industries.

And in entering on any joint enterprise whereby we may be enabled to extend our trade, the fact must never be lost sight of that we are the nation by whose industrial enterprise this existing trade in the upper Yang-tze regions has been built up, and that the immense preponderance of British trade should still give us a controlling voice in any joint foreign enterprise in these regions, the epithet "foreign" being meant to express that of any nation other than of China herself.

Were it not for the trade which British industry has already established, any such project as that which we are considering would not have become practicable, and our neighbours should be the first to recognize the justice of these grounds of our claim to a predominant position in any joint enterprise.

Allusion has already been made to the extent to which our Indian empire is interested in the sea-borne trade of these upper Yang-tze regions, and how India must therefore be particularly concerned in

MODE OF PILGRIM TRANSPORT UP SACRED MOUNTAIN.

anything that may lead to the security of this trade and its expansion. Let us now consider in what other directions India will be affected by the opening up of Se-chuan by a railway entering the province from the lower Yang-tze regions.

At present Indian merchandise from Bombay and Calcutta is shipped to Shanghai, and thence has to be conveyed by steamer 1000 miles up the Yang-tze, twice breaking cargo, finally to be taken up by junk for a perilous voyage of 500 miles or more.

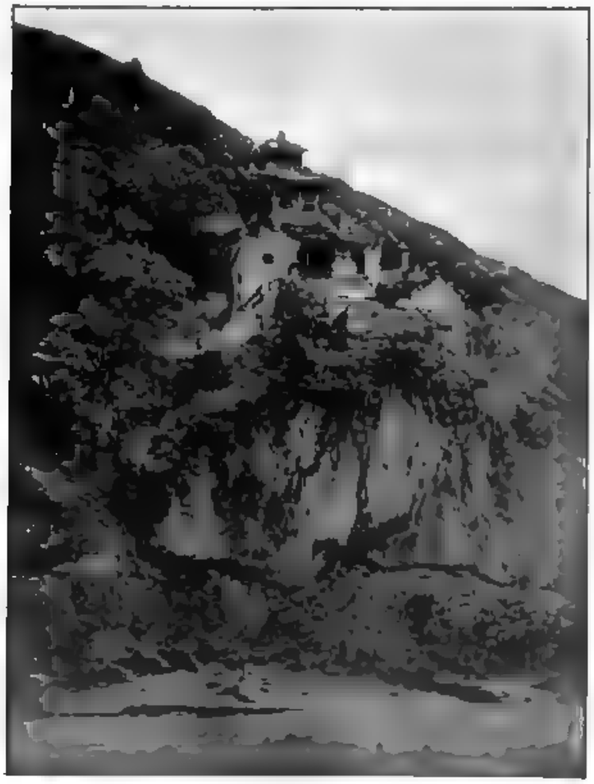
It is very obvious how greatly India must be interested, not only in securing a rapid and safe journey for her merchandise, but also in encouraging and forwarding any sound scheme which may lead to a further development of these markets, the outskirts of which she has so far touched on, as shown by the immense leap this one trade in cotton yarn has taken in the last two years, during which period Indian imports into Se-chuan have exactly doubled.

The purchasing powers of the fifty millions in Se-chuan can be increased to an enormous extent as their opportunities for developing the latent resources of their province and a safer and sure means of transport are afforded, and not only of these fifty, but also of the odd millions who can be reached on the borders of Kan-suh, Tibet, Kwei-chau, and Yun-nan.

One half of the trade which at present goes up the Yang-tze beyond Chung-king is intended for Yun-nan, and, though I have been dealing chiefly with the question of a railway into Se-chuan from the lower Yang-tze, Yun-nan and its development is so connected with this problem that we may for a moment consider a question in which India must eventually be still more interested—that of her direct land communications with Western China and the upper Yang-tze, and how these will be ultimately affected by this railway into Se-chuan from the lower Yang-tze provinces. The railway entering Se-chuan from the lower Yang-tze, as it opens out the province and throws out branches, will undoubtedly lead in time to an extension to meet it being made from Yun-nan Fu, to which place the French railway is now being carried from the gulf of Tongking. This is purely a French line, and will give the French enormous interests in eastern Yun-nan. State support, as well as the natural features of the country, have enabled the French to carry out the construction of this railway. The general trend of the ranges between Yun-nan Fu and Tongking lend themselves to such a line. It is natural that the trade from Eastern Yun-nan should follow not only the easiest route, but what is also the nearest line for communication with the ocean, and this the Tong-king line undoubtedly affords. But it must always be kept in mind that this advantage only applies to Eastern Yun-nan and its capital, Yun-nan Fu, and it is only to the latter that the French can establish by natural advantages any exclusive right of way.

British trade has so far more than held its own in the far richer western portion of the province, and has so far secured the whole of the trade of the important centre of Ta-li Fu and of the populous plains near it. Yun-nan Fu, as the capital of the province and as the centre to which French activity is directed, has received an undue share of attention in itself, and is liable to be considered as the main objective for any line from Burma. As pointed out to us by Major H. R. Davies, to whose careful survey and explorations we are indebted for a thorough

knowledge of Yun-nan, the capital lies in the poorer half of the province, whereas the richest districts in the province are those in the neighbourhood of Ta-li Fu, whose natural source of supply under present conditions is Bhamo. From the commercial centre of these Ta-li Fu districts to Bhamo, with its connections by large river steamers to the ocean, is a distance of 280 miles; whereas from Ta-li Fu to Manhao, the head of navigation for large junks on the Red river trading with Tong-king, is 396 miles; so that with this advantage of proximity



TEMPLE ON HAN RIVER.

to Bhamo, it is only natural that the Western Yun-nan trade should be British.

The railway entering Se-chuan from the lower Yang-tze, as it opens up the province and throws out branches, will undoubtedly lead in time to an extension to meet it being made from Yun-nan Fu, to which place the French railway is now being carried from the Gulf of Tong-king. This is purely a French line, and will give the French enormous interests in Eastern Yun-nan. State support, as well as the natural

features of the country, have enabled the French to carry out the construction of this railway, the general trend of the ranges and valleys between Yun-nan Fu and Tong-king lending themselves to such a line.

But when the French have completed their railway to Yun-nan Fu this favourable state of affairs will cease to exist, as there will then be a distance of only 220 miles between Ta-li Fu and the French railway, as against the 280 miles to Bhamo. Thus the trade of Western Yun-nan will be transferred to the French and the Gulf of Tong-king, and though it may be of only small dimensions at present, it is one capable of great expansion in the future, and one we cannot therefore afford to lose. Therefore, unless we are to sit down quietly and lose the prospects of this great future trade, we must do something at once.

The difficulties of a railway route from Burma through Yun-nan are well known, but though such a line may not enter into the range of practical politics in the immediate present, and does not call for prompt action being taken in the way this line between the lower Yang-tze provinces and Se-chuan does, yet we cannot lose sight of the fact that in this great empire of ours, so dependent on its trade, we must often enter on what may be, in the present, unproductive expenditure to provide for future contingencies. Therefore, after India has developed her internal railways, she may well find it to her interest to extend her trade relations and facilitate them by railway construction from her land frontiers conterminous with those of China. She may not be able to enter on any scheme embracing a railway line through Yun-nan into Se-chuan in its entirety for a long period yet, but she can take steps before it is too late to secure a trade outlet for the future, so as to ensure the full enjoyment of all advantages in the trade of Yun-nan, which province, in the course of time, as it regains its population, which has only temporarily been lost, and as its undoubted mineral wealth is developed, will become one of the most prosperous in China.

A magnificent scheme only proves such when it can be carried out with some great advantage gained beyond that of accomplishing a splendid engineering feat or a hollow political triumph with nothing but empty vainglory resulting. A Burmah-Yang-tze line is, therefore, undoubtedly a project to be carefully weighed over before any step is taken, and if found wanting, to be rejected. But it must be kept in mind that, though the trade offered by Yun-nan may at the present time be but small, it is necessary to look beyond this, and any one who does so, and also studies its past history as well as what its future must bring forth, will see that Yun-nan has enjoyed in the past much richer and more prosperous conditions. With the overflow of excess population from Se-chuan, these conditions will not

only be attained again, but with the spread of modern industrial methods and the development of modern communications, must be far surpassed.

Unless this planet were to stand still these naturally rich provinces must advance with the rest of the world. But Se-chuan must first be opened up from the east, and the increased prosperity which rapid and safe means of communication bring to this province will cause new outlets to be sought, and these will be in the direction of Yun-nan, which by then will have been opened up by the French railway as far as Yun-nan Fu, the capital. The importance of this line from the lower Yang-tze rests not only on its being a sound undertaking financially, but also on the fact that it will become the centre from which will radiate the great system of railways stretching from the Indian ocean to the North China seas, and which will enable us to secure for British manufacturers the market of the millions of people which, under the present limited means of communication, we have barely been able to touch upon.

The information obtained in our journeys may, I hope, form a stepping-stone towards this result. I have not been able to enter so fully into our routes as those interested to-night might have wished; but I hope later on, when it is expedient to do so, that a map may be produced for the *Journal* of the Society in which the knowledge of the basin of Se-chuan and its approaches gained by the labours of the parties to which I have had the honour in the past four years to conduct to these parts will be available; and as over 8000 miles of routes were traversed by trained surveyors and mapped on a scale of 2 miles to the inch and observations systematically taken, it will, I hope, prove a useful addition to our geographical knowledge; and it will be found, I hope, that a key to the problem of opening out these upper Yang-tze regions, so important to our commerce, will have been furnished.

Before the reading of the paper, the PRESIDENT said : The meeting will remember a very interesting paper Colonel Manifold read to us about eighteen months ago. Since that time he has again made a very important journey to the regions of the headwaters of the Yang-tze, of which he will give us an account to-night. I will now ask Colonel Manifold to read his paper.

After the reading of the paper—

Sir GEORGE SCOTT : I have not had the advantage of being over that part of the country about which Colonel Manifold has lectured so very ably and graphically to-night, but I have been on sections of the Yang-tze to which he has referred. Last August I went up from Shanghai to Hankau, and from Hankau I went over the railway line to Peking. At that time, I am sorry to say, the railway was not finished, but from Hankau I took a ticket to Yencheng, a place 20 or 30 miles north of the point Colonel Manifold pointed out to you on the map from which he started for the Han river. From Yencheng I had to go on by construction trains, and a number of bridges had been washed away by heavy rains, so that I was deposited in the middle of some maize-fields some distance from a village. At the village

there were no carts, so I had to adopt the mode of transit for my baggage which Colonel Manifold showed you—I had to take wheelbarrows for a distance of 30 miles to the Yellow river, and from the Yellow river I had to put up with jolting in carts, which was very much worse than the sedan-chairs of which he spoke. They are very tiring, and at the end you generally feel as though you had been run over in a football scrimmage. It took me two months to recover from the bruises. At Hsin Hsiang, a fair-sized town, almost due west of Wei-Hui-Fu, a British line crosses the Pe-han railway, and trains were running backwards and forwards. They do not go far, but eventually I dare say it will connect the German railway with Huai-ching. At that moment it ended at some coal-mines which Mr. Jamieson is digging. Unfortunately, a great deal of water was coming into the mine, and so far as I know they have not got any coal out yet. From Cheng-te to Shun-te Fu, I had to travel by ballast train. What struck me most was the enthusiasm with which the Chinese used the trains. The guards and railway construction people were not people of the most exalted morality, and although the coolies were supposed to ride on the ballast-trucks for nothing, these people all took fees from them, and the way the Chinese dodged round to try and get on the trucks convinced me that a railway anywhere in China is certain to pay. About the middle part of China, the country round about the Han river, I know nothing, but Colonel Manifold has told you as much as any one is likely to know. From the Bhamo side I do know something about the approaches to the Yang-tze river, and I am sorry to say Colonel Manifold is not so enthusiastic about the railway from that side as I should like to have seen him. The whole question of a railway from that side has been prejudiced by Colborne Baber, who said that a railway there would have to be a series of bridges and tunnels. Well, if you start from Bhamo, which was the point Colonel Manifold did start from, you would have to build these bridges and tunnels. But some years ago some one asked, was there not a way round, and in this case there is a way round. Nature has provided us with a geological fault. Colonel Manifold told us that the rivers and the ridges ran due north and south, and so they do in most places, but in one place, directly in a line with Mandalay, there is a curious fault—the line of rocks run due east and west, and up this from Mandalay a railway has been built. This line, however, reminds me rather of the road of which we saw beautiful pictures, built, I think, by the Se-chuan men. But it seems to me we are like the Hupeh men in so far as we are faint-hearted, and have not finished the line. The railway so far stops at Lashio, and if it goes no further it will never pay, but if we carry it along this geological fault to China or into China it will be a success. The fault leads us not only to the Salwin river, but it gives us a route up the Nam Ting to the Mekong river watershed. Colonel Manifold referred to Major Davies' journey up there. He was in a hurry to get to Tali-Fu, and therefore he took the most direct line. Captain Watts-Jones, who was killed by the Boxers, went up more or less prospecting for a railway, but he also wanted to go as fast as he could, and so he went the same way, and this line of crossing the Mekong is certainly very difficult. The proper route would be to cross southwards from the Nam Tinl to the Nam Hsunl, down which the Mekong could be easily approached. The country in between is a series of anastomosing streams. The rivers appear and disappear in a most extraordinary way, so that you do not know which way they are going. But in any case a good railway expert is wanted to examine this route, and if once the railway could be got across the Mekong to Ching-Tung, then there is no difficulty whatever in going north towards Tali-Fu, or, better still, to a point halfway between Tali and Yunnan-Fu, whence there is an easy approach to the Yang-tze. I am inclined to think this railway would pay very well. But the Royal Geographical

Society, as a rule, does not care very much to talk about trade or about politics, so I will only say that so far as Colonel Manifold referred to this question I will say ditto to him, and I will put it on the ground which is much more in the way of the Royal Geographical Society—of the ethnological question. The country north of Tali-fu is the place where we shall find, if we ever do find, the solution of a great many of the puzzling questions of the different races who inhabit the frontier hills. We want to find out a great deal more about the Akha, and we want to know about the Lahu. At present the learned authors of the linguistic survey of India, whenever they find one of these tribes of which they do not know much and of which the vocabularies are not very extensive, immediately put it into the Tibeto-Burman class, which is very much what we used to do as boys; if we met a place that looked like a town we put it in Asia Minor, and if it looked like an island we put it in the Ægean sea. I will not further trespass on your time, but I know I shall be expressing your feelings in thanking Colonel Manifold for his very excellent paper.

Mr. Byron Brennan: I think that anybody who has paid attention to the paper which has been read by Colonel Manifold must feel persuaded, if he was not already convinced, that there are great advantages for all concerned, for the province of Se-chuan itself, for all foreign countries which have commercial relations with China, and for those with whose money and by whose energy the great work will be completed, there is a great advantage for all if a railway can be constructed which will link up the province of Se-chuan with China, and thereby with the rest of the world. The wealth of the province and its latent resources have been referred to by every one who has been there, and the easy circumstances of the well-to-do population have been remarked by every observant traveller. I suppose of that population, which is loosely put down at from forty to sixty millions, their only grievance is that they are unable to share the bounteous gifts of Providence with less fortunate people outside. Se-chuan may be reached from two directions, from the east and from the south-west by way of Burma and Tong-king. I think, if only commercial and financial prospects are taken into consideration, there is no question that the first railway must be built by the east, that is reaching Se-chuan by the front door; and what use we make of the back door must be left for future consideration when events have developed. Naturally, the lecturer did not tell us very much about the routes he had followed; but I think we may all take it for granted that there are no insuperable difficulties in constructing a line, and that if we had had the hold on China that we have in India, a line would have been constructed long ago. But it may very well be that there are no serious physical obstacles, and that the railways are sure to come, but that is not all. We have to remember that China is an independent country, that we cannot force railways upon her—at least, England is not the nation to do so—so that any railways in which we have a hand must be constructed with the consent of the Chinese Government. Colonel Manifold has told us that there is one serious obstacle that the provincial authorities have stated their opinion that they would like to provide the money and retain the control of the railways in their own hands. I quite agree with him; there is not the slightest chance of a tithe of the money being found on those conditions. No Chinaman will put money into a concern controlled by Chinese. But if the province is unable to do the work, the central government will then say they must have recourse to foreign capital. But that is not a matter to discuss here. I do not think we may expect much difficulty from the second obstacle which Colonel Manifold mentions—I mean the agreement between England and France whereby both countries are not to seek exclusive advantages or monopolies in the province of Se-chuan or Yun-nan. That must have meant that

neither Government would seek to do so, but not, certainly, that private individuals are debarred from entering into enterprises without going halves with the other side. I think it would be a very good thing if the Chinese Government would institute a railway department worthy of confidence, and one that would give satisfactory guarantees that the money provided by foreigners would be properly and honestly spent. I know of no place in China where such a department would have a better chance of making a beginning and with a greater chance of success than in that region which has formed the subject of Colonel Manifold's very interesting paper.

The PRESIDENT: The meeting has to thank Colonel Manifold for a most interesting and entertaining paper, in which, admirably illustrated as it was, he has given us an idea of that remarkable region which he has explored, many parts of which, I believe, have never before been visited by any European. He has filled our minds with political ideas and ideas respecting the construction of railroads, but yet with very remarkable skill he has never himself gone beyond the bounds of the geographical aspects of these questions. I am sure you will all join with me in passing a very hearty vote of thanks to Colonel Manifold for his very valuable paper.

C. REGINALD ENOCK'S JOURNEYS IN PERU.*

By Sir CLEMENTS R. MARKHAM, K.C.B., President R.G.S.

MR. ENOCK, an observant traveller and enterprising mining engineer, has favoured us with five interesting papers narrating his adventurous journeys in the snowy cordillera to the east of the long lateral valley of Huaylas, in Peru, his experiences in the lofty highlands and on the ice-caps, and his attempted ascent of a virgin Andean peak.

The first paper describes his exploration of a pass over the eastern cordillera; the second narrates a journey in the region where the rivers Marañon and Huaylas take their rise; the third is on the ruins of Huanuco; the fourth is on an upper section of the valley of the Marañon; and the fifth relates Mr. Enock's attempt to ascend the peak of Huascaran.

I have found it necessary to condense them into one paper.

I. *Pass across the Snowy Cordillera.*

On October 3, 1903, an English engineer named C. Reginald Enock left the Peruvian city of Huaraz with the object of exploring a pass in the Cordillera Blanca, or snowy cordillera of the Andes, which bounds the valley of Huaylas, in which Huaraz is situated, to the east.

* Read at the Royal Geographical Society, January 9, 1905. Map, p. 700. In a subsequent number will be published a paper by Mr. Enock on "The Ruins of Huanuco Viejo."

A glance at the map of Peru will render clear the formation of this valley, which is known as the Callejon de Huaylas. It is a lateral valley of the Andes, bounded by lofty mountains on either side, with a river finally breaking through the western or maritime cordillera after a course from south to north, and reaching the Pacific as the Santa. This lateral valley, 80 miles long, is a very remarkable feature of the Andes. The city of Huaraz is 9908 feet above the sea.

On the eastern cordillera, to the north of Huaraz, the magnificent peak of Huascaran, 22,048 feet above the sea, reflects the morning or evening sun in glorious tints, and rises upwards towards the ever-blue heavens in impenetrable majesty—beautiful, solitary, eternal.

Impenetrable, because no human foot has ever pressed its summit. The famous savant and traveller Raimondi attempted its ascent, but without accomplishing it.

The object of Mr. Enock's exploration was to determine the practicability of constructing a mule road to connect Humaraz with other towns on the eastern side of the snowy cordillera, especially Huari and Huantar. This route would lead to a large part of the interior known as the Montaña.

Accompanied by four young Peruvians of Huaraz, a guide, and eight Indians, who carried the baggage and instruments, Mr. Enock ascended a ravine called Quillcay-huanca, and formed his camp at the foot of a glacier which is the source of the Quillcay river. The height was 13,288 feet, the western edge of the perpetual snow-line.

Sleep was continually disturbed by the thundering of the avalanches. Next morning the party ascended the rocky wall on the right-hand side of the ravine, and entered upon the snow-cap.

Here all secured themselves to the rope which had been brought for the purpose, as numerous crevasses were encountered, in many cases invisible owing to the coverings of snow which concealed them. The ascent was gradual, and soon the snow began to fall thickly, which entirely obscured the view. In the face of this the party was brought to a standstill, for in the darkness a false step might have precipitated one and all into a crevasse.

When the sky cleared the party resumed their difficult march, and eventually reached the summit. Here a view was obtained of the eastern side of the cordillera. In front long slopes and sheer descents extended downwards, the former crossed by yawning crevasses of unknown depth, among which there appeared to be no passage. Beneath their feet the snow, heavily fallen during the night on that side of the mountains, lay to such a depth that at every step they were buried to the waist. Above their heads the sun, which for a few brief minutes had appeared, again became obscured by falling snow. "Let us go back," was the cry of Mr. Enock's companions. But to this he opposed a firm negative, determined to complete what had been begun,

and believing that, with calmness and caution, an advance was feasible. Seeing that every minute added to the obscurity owing to the thickly falling snow, he took the guide's place, and, animating the others, they slowly commenced the descent, sinking waist-deep at every step. Progress was slow, laborious, and exceedingly fatiguing.

In spite of all their caution there were some narrow escapes. For instance, in descending a slope Mr. Enock felt that the ground beneath his feet was giving way. It was a crevasse, the bridge over which had broken through. He obtained a momentary glance of the ice-walls below, which extended downwards until lost in obscurity, but, with the quickness of thought, he threw himself backwards at full length on the snow, and slowly retreated, making signs to his followers to do likewise. The remnants of the snow-bridge slowly slid into the abyss, and they sought another way.

Wet, cold, and hungry, their privations were increased by the carelessness of the Indian who carried the basket of provisions and cooking utensils. While descending a slope, Mr. Enock was horrified at the sight of these articles rolling past him. He made a wild grab at the tea-kettle, but missed it, and, together with the provisions, it disappeared into a crevasse. Fortunately none of the party suffered from the dreaded *sorochi*, or mountain sickness.

After reaching the eastern limit of the perpetual snow-line, and regaining the solid rock, the descent was easier. They came to the valley down which the river Pamparaju flows, and passed the night in one of the caves which exist there. An infusion of coca leaves was agreeable and sustaining, while a native remedy (a starchy tuberous root) cured the effects of snow-blindness.

The principal point of geographical interest of the region, apart from the route as a means of communication, is that the summit they crossed is the water-parting of the continent east and west. The waters of the river Quillcay, where the ascent was made, flow to the Pacific ocean; those of the Pamparaju, where the descent was accomplished, flow to the Atlantic. The greatest altitude gained was 16,076 feet. The width of the perpetual snow-cap was about 4 miles. The rock formation of the lower slopes is a hard porphyry, capped higher up, and probably beneath the snow, with a slate, fast disintegrating under the action of the elements.

Not far from the town of Huari the ancient Inca road from Cuzco to Quito passes, and in the town of Chavin, near at hand, is the famous old Inca fortress. Numerous well-carved stones, often built into the walls on modern houses, attest the skill of those ancient workmen.

The coca leaf, as is well known, produces the alkaloid known as cocaine, of which a considerable quantity is manufactured in this valley of the Marañon and exported to Europe. The coca leaf itself is the

Indian's best friend. Provided with a pouch full, and a small gourd of carbonate of lime, the Indian can abstain from food for days together during a long journey without any loss of energy. Mr. Enock found this leaf beneficial in the form of an infusion, and he believes that its use might be advantageously adopted in Europe.

He describes the country east of the snowy cordillera as both magnificent and interesting. Copper, silver, gold, lead, and quicksilver are found in lodes or deposits, and anthracite coal is abundant.

II. *Sources of the Marañon and Huaylas.*

Mr. Enock's next journey was to the headwaters of the river Marañon. There are two streams coming from south and south-west, which unite near the town of Pachas. That from the south is the Marañon proper, flowing from its source in Lake Lauricocha. That from the south-west is the Vizcarra, and has its origin in the cordillera of the Andes near Huarapasca.

Mr. Enock travelled down the valley of the Vizcarra to Huallanca, a small place which is of growing importance owing to mining enterprise and development. In the neighbourhood there are very extensive deposits of anthracite coal, which, in some future time, must cause this region to become important. The coal-seams, in many cases, stand vertically within their enclosing strata, which have been very much upheaved and distorted. They tower up to a height of several hundreds of feet above the river, and lend themselves to economical mining methods.

Leaving the Vizcarra on the west, near its headwaters, Mr. Enock arrived within a short distance of his objective point, Chonta, when a fierce snowstorm overtook him and caused him to lose the track. On many of these mountain uplands, or "punas," there are extensive swamps, and across one of these Mr. Enock's party floundered for hours. Night was upon them. There were no habitations and no fuel in the vicinity, except dried grass. Here they had to camp at a height of 15,748 feet above the sea. The icy blast blew through and through them, and the water poured in beneath the bottom edge of the canvas tent. But the traveller who has chosen the winter for his journeys in the Andes against the advice of his friends must make light of the consequences. Mr. Enock did so. He dug a trench on the upper side of the tent, the snow covered the canvas and afforded protection from the cold, and he succeeded in making some coffee. Three Indians were his only companions during this arduous expedition, and they suffered the hardships they had to encounter without a murmur. Wet to the skin and exhausted with the day's work, they nevertheless made every effort to secure the comfort of their *patron*. Next day all the troubles were forgotten when Mr. Enock examined his concession at Chonta,

which proved to be of great value. It embraced a large area of cinnabar-yielding formation, and he thinks it may prove to be one of the most important quicksilver-mines in the world. The altitude is 15,300 feet above the sea.

From Chonta Mr. Enock obtained a view of the hills which bound Lake Lauricocha, the source of the Amazons, backed by a magnificent range of snow-capped peaks.

From this point his return journey to Huaraz began, crossing the cordillera again by another pass, that of Huarapasca, at a height of 15,666 feet. After encountering a furious gale on the summit, he journeyed onward and downwards. The formation is limestone, and Mr. Enock halted to sketch a huge fossil ammonite, which stands facing the road like a stone covered with an Inca scroll. The number of fossil ammonites at this point is remarkable. The diameter of one he measured was 32 inches across.

There are three cordilleras to be passed by this route, that is to say, three undulations of the cordillera, and after two days' riding the party descended into the plain of Lampas, which is 10 leagues broad, and remarkable for its exceeding flatness. It is of gravel formation, partly auriferous, and on its south-west side is Lake Cono-cocha, the source of the river Huaylas. From this point the road leads down the valley, for 50 miles, to the city of Huaraz.

III. *Ruins of Huanuco.*

Mr. Enock's next journey was to the famous Inca ruins of Huanuco Viejo. They are near the upper course of the Huallaga river, one of the great southern tributaries of the Amazons. The ruins are on the western verge of a level tableland composed of quartzite and limestone conglomerate. The hills bounding its northern and eastern sides are vast cliffs of similar materials. The height above the sea is 11,811 feet.

There are very extensive remains of a once populous town, and ruins of a fortress and a palace. The architectural features which are most noteworthy are the stone doorways. The joints of the stones are so closely fitted that a knife-blade cannot be introduced, some of them monoliths more than 7 feet long.

Mr. Enock gives a detailed and most valuable account of the Huanuco ruins. Very picturesque and impressive, he concludes, was the place as the long shadows fell across the tableland, the sun's disc nearing the western horizon upon the hills which crown the Vizcarra. The clouds, a scarlet curtain of texture fine and filmy, strove as if to hide his exit, and from below, rather than from above, appeared the shades of evening.

Some attraction, born of the influence of the dying day, held me, he

writes, momentarily to the place, contemplating those old sad vestiges of a perished civilization.

IV. *Valley of the Marañon.*

Towards the end of March, 1904, Mr. Enock returned from a fourth expedition, which was undertaken to examine and take possession of some gold and quicksilver concessions, as well as to study the geological structure of the valley of the upper Marañon.

Crossing the cordillera, he reached the town of Huantar, a very primitive place near the river Paccha, a tributary of the Marañon. Higher up the Paccha valley are the ruins of the Inca fortress of Chavin, which are extensive, principally subterraneous, and built of squared stones carefully set. There is a series of small square underground chambers, communicating with each other by passages, and also by curious small horizontal shafts. It is stated that below these chambers there is another similar series. Close to the fortress there is an Inca bridge spanning a mountain stream.

The distance from Chavin to Huaraz, across the cordillera by the pass of Yangshallas, is only about 55 miles; and here the projected Pan-American railway would pass, by means of a tunnel. The formation is limestone, which stands up in enormous vertical strata. Numerous small lakes occur, presenting the appearance of having been artificially dammed up. The embankments are really moraines left by the retiring snow-cap, which has receded very notably during the last century.

Mr. Enock went eastward from the cordillera, and pitched his tent on a green meadow near the river Marañon, which, in this upper part of its course, is small. The valley slopes are cultivated with maize and potatoes, and there are numerous villages on the banks, their white walls and red-tiled roofs giving an air of smiling prosperity. The bridge of Chuquibamba, leading to the Montaña or tropical forests of the interior, is a primitive structure. It consists of logs covered with twigs and soil, at a point where the river is narrowed between perpendicular cliffs to a width of 32 feet.

The river Marañon is famous, at this point, for the occurrence of gold in its bed, and the principal occupation of the inhabitants is gold-washing. Mr. Enock has personally obtained gold-dust and small nuggets from the gravel at the verge, and has purchased nuggets of gold, weighing up to half an ounce, from the Indians. There is not the least doubt that great wealth is contained here. Below the bridge the river widens out into a species of whirlpool, which, according to the natives, contains a vast quantity of gold, deposited by the current.

The geological formation of the valley of the Marañon, in this

region, is a talcose slate occurring in thin bands alternating with quartz. The rocks have been much twisted, folded, and contorted probably by "end pressure," and the quartz may be an after-deposit between the laminæ. On the western summit of the river-valley there is a cap of white sandstone, and on the eastern of red slate-quartz conglomerates.

Leaving the river, Mr. Enock proceeded eastward towards the Montaña, arriving at the lakes of Carpa, only a few miles from the tropical forests of Monzon, where there are several factories for the production of cocaine.

In the neighbourhood of the village of Tantamayu, about 4 leagues from Chuquibamba, there are numerous Inca ruins, including a remarkable row of square towers on the summit of a hill. A little further on the ruined walls and towers of an ancient village are massed on a ridge on the opposite side of the valley. Above rolled the sombre night clouds, beneath were the folds of mist which arose from the Marañon, 6500 feet below—the white fleecy mist which only the mid-day sun dispels.

There is nothing which arrests the attention of the traveller in the Andes more than the peculiar aspect which the long slopes present, due to an ancient cultivation. At first sight he is unable to explain the remarkable rippled appearance, until he sees that it is the result of innumerable terraces which have once been narrow plantations or fields, partly excavated on the upper, and embanked on the outer side. The evidence of a very large ancient population is shown by the fact that, in most of these extensive regions, every possible square foot of ground is so terraced, and has at one time been cultivated, however inaccessible it may appear to be. The very extensive ruins of habitations also bear witness to a very numerous ancient population.

The rapid changes of climate are very marked. The traveller may be under the inclement conditions of the lofty "puna" * in the early morning, whilst in the afternoon he may find himself where oranges and lemons grow. At elevations from 10,000 to 13,000 feet a flora very similar to that of the south of England is encountered, and some of the uplands are very like Devonshire—the same hills and streams, the same moist soft atmosphere, the veils of mist and rushing streams of distant Dartmoor, ferns and nettles, fields carpeted with buttercups in bloom, and violets and stitchwort beneath grey stone walls or on mossy banks. But there is little timber; the *quishuar* † and *quenua* ‡ being the trees that principally predominate.

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* A lofty plateau of the Andes.

† *Buddleia Incana.* ‡ *Polylepis racemosa.*

V. *Ascent of Huascaran.*

The last paper received from Mr. Enock contains the narrative of his attempt to ascend the peak of Huascaran.

He had left the town of Yungay last May, with the object of examining some gold-mines near the base of the snowy cordillera. The peak towered above him, so he resolved to attempt the ascent, and sent back to Yungay for blankets, provisions, blue spectacles, small hatchets, and a stout rope. Guides there were none. The party consisted of Mr. Enock, an Italian, Don Cesar Cisneros (a Peruvian), and five Indians. The way at first lay up comparatively easy slopes and ravines, through thickets of *quenua* and *quishuar* trees, and among flowering shrubs. At 11,400 feet the Italian was too tired to proceed; the rest pushed on.

The slopes for several hundred feet below the perpetual snow-line are steep and bare of vegetation, and covered with loose granite blocks. Cisneros suffered from *sorochi*, but continued manfully upwards. At eleven they reached the snow-line at 14,500 feet, and halted for breakfast. Mr. Enock continued to be absolutely free from *sorochi*, the *chancaca* (cake of brown sugar), eaten at intervals, undoubtedly having a good effect in staving it off.

Continuing the ascent, the snow was soft at first, with a thin crust of harder snow, which just bore the weight of a man if he advanced with care. Cisneros was unable to proceed, and remained behind with an Indian. The other four went on with Mr. Enock; but one of them broke through the crust, and was buried up to his armpits in soft snow. This so terrified the others that they would proceed no further. The aspect of the glaciers beyond was imposing. Fearful precipices were exposed to view, showing where avalanches had fallen, and laying bare vertical sections of the ice-cap, which, in successive layers of different stages of thickness, showed their relative ages. On a distant slope an avalanche fell, and the resounding roar echoed grimly among the high ravines and terraces.

During this portion of the ascent Mr. Enock had hopes of attaining the summit, and he therefore witnessed the timidity of the Indians with disappointment and anger. In vain he offered them rewards; they would not move. He proceeded onwards alone.

On reaching 16,500 feet he was obliged to halt. Before him was a profound crevasse, and he hesitated on the verge. Beyond the twin peaks of Huascaran glistened like purest porcelain in the rays of the afternoon sun. Blue and pearly shadows shaded gently off upon their flanks to meet the green profundities, and sheer below the foamy blanket of the avalanche now lay, the mist of its pulverization still hanging in a faint white curtain near the base. Nearly 6000 feet above the white point of the northernmost peak quivered in the blue heavens, like the gnomon of a sun-dial, along whose sloping side the ascent might be possible.

Mr. Enock resolved to push on alone, crossing the crevasse, and advancing up the ice-cap. But it was only to find another deeper and wider chasm, with others in close proximity. The snow-cap was folded and cracked, but by no means impassable with proper appliances and companions. But to advance alone was to court destruction. He reluctantly decided to return.

The majesty of the vast heights was fascinating. No human foot had pressed those slopes before. He was absolutely the first to have visited the virgin solitudes. Far below the long valley of Huaylas lay, threaded by its river. Not a cloud rested on the twin summits of Huascaran. On their outer sides huge entablatures of snow, vast cornices of unsupported ice, stood out, overhanging the gulf below in fearful equilibrium, and casting sharp shadows on the white façade over which they projected.

He turned very reluctantly, and followed his footprints down again, passed the crevasse, and reached the place where the Indians were waiting for him. Late in the evening the whole party returned to the mine at the base of Huascaran. Mr. Enock was convinced that, with more experienced companions and better equipment, the summit might be reached, and he cherishes the hope of accomplishing the feat himself.

The name of the mountain was given by Raimondi. Its real name is Mata-raju, which means "the double point of snow."

Before the paper, the PRESIDENT said: Mr. Reginald Enock, the author of the paper that is to be read to you this evening, is still travelling in Peru. He is a very intelligent, enterprising young mining engineer, and he has sent us home as many as five papers describing his various journeys in a very interesting part of the Andes of Peru, and also a number of photographs and drawings. One of the papers will be printed in the *Journal*, but it was necessary that I should condense the others for reading this evening.

After the paper, the PRESIDENT said: There are several gentlemen who are interested in this, from a commercial point of view, extremely important part of the Peruvian Andes, and I will ask Mr. Schafer, who has a concession for a railway, to speak.

Mr. SCHAFER: I am sure that, after having heard this interesting paper, you will all be convinced that a matter of great interest would be the building of a railroad in order to reach the very important riches which Mr. Enock has referred to. He has not described the ease with which a railway could be built to the headwaters of the Huaylas or Santa river. But by looking at the map it will be seen that, starting at the Lake of Conococha, the river runs through the town of Huaraz, and breaks through the cordillera below Huaylas at Cañon Pato. It then flows west to a town called Santa. South of Santa is a very important bay, which is known to be the best deep-harbour bay on the west coast. From this bay a railway has already been started some years ago by the Government of Peru, and it was built by the contractor Meiggs. It reaches a place called Suchiman, 30 miles from the bay. From there it could easily be built along the river Santa, passing through a cañon which has been cut by that river, and by a very gradual slope it would reach the town of Caraz and Huaraz, and thus come within easy

reach of the department of Huari, which Mr. Enock has so ably described. It would be the only railway that could be built with easy gradients. All other railroads, to reach this fertile and rich interior, would have to be built along the side of the mountains in zigzag form, and reach altitudes varying from 14,000 to 16,000 feet, whereas this Santa river railway has gradients at the very outset of 2 per cent. It appears to me that Mr. Enock has found some very valuable mines and other concessions in the interior, but they certainly are very inaccessible until this railway has been built, and there are a number of gentlemen here present who will be pleased to hear that it is quite possible that within a very short time the work of building that railroad will commence, and that it will be done with British capital. English capital has not been very enterprising in that part of the world for some years, because Peru has been rather at a discount; but recently, through the interesting papers such as Mr. Enock and others have written, some interest has been taken, and it is believed that a railway built from a good port and up this magnificent valley will be an enterprise which English people will have reason to be proud of. I think there are some engineers present who have been over this route as far as Huaraz, and probably they will be able to give you some information.

Mr. G. ALLEN CRANE: Mr. Schafer has described the route which the railway will take, and I will just add a few words as to the district which it will probably tap. When I made my trip, I started from Chimbote, and followed the valley up as far as a river which is not marked on this map.* I followed the course of this river to a place called Pallasca, 60 miles up the valley, and in that district the natives also wash gold just as Mr. Enock has described that they wash it on the Marañon. In the course of the year they collect a considerable amount. All that country is very highly mineralized, and contains copper as well as gold. Further up the Santa river there are large seams of anthracite and semi-anthracite, and, higher up the mountains, bituminous coal, all of which can be easily transported to the coast when the railway reaches it. From Suchiman, where the railway runs at present, to the beginning of the coal-seams is a distance of about 30 miles, and this part of the railway could be built within a very short time. Coal can then be brought to the coast and used on the steamers, and can also supply all the ports on the west coast of South America. These seams of coal can be traced for 20 miles up the course of the river. The seam runs horizontally, and sometimes there are two or three seams one above the other, varying in thickness from 4 to 20 feet. The cañon that Mr. Schafer has spoken of lies to the north-east of Huaylas, which is marked on the map, and there the coal is of especially good quality for all purposes. Further up the river, at Caraz, is more coal; in fact, the town is built on a coal-seam, which dips under the town and outcrops on the banks of the river. All along both sides in the Cordillera, Negra, and the Cordillera Blanca are silver and copper mines, which at the present moment are unable to be worked. Owing to the lack of transport, it is difficult to get ore down to the coast from the mines, as the only way it can be done is over the rough tracks, carrying the ore on the backs of mules. Still following the valley, the railway would tap the copper region of Aija, which is to the south-west of Huaraz about 20 miles. This is a well-known copper district, and a British company is at present developing a large property there. The terminus of the railway (Recuay) is a mining centre also for copper and silver. Independently of the mineral wealth of that district of Perú, the valley itself is most fertile. The natives grow wheat,

* If you look at the most northerly part of the Santa river, you will see a river flowing into it from the north. This is known as the Chuquicara.

corn, sugar, alfalfa, vegetables, etc., besides all descriptions of fruit; but as they cannot at present get a market for their products, owing to lack of transport facilities, they only produce enough for their own consumption.

The department of Ancachs, through which the railway will run, has a population estimated at over 300,000, so it can be readily seen what a boon the advent of such a line will be to the inhabitants.

Colonel CHURCH: I had not intended to be present this evening, but Peru, from old associations, has such attractions that I was obliged to come. I may say—and perhaps it may be a bold statement—that Peru is just commencing, in fact, is in the infancy of, her industrial development. This evening the paper relates more to this than it does to the geographical features of the country. One statement may be corrected. A very long time ago Padre Samuel Fritz, one of the most famous missionaries of the eastern slope of the Andes, said that the Marañon rises in Lake Lauricocha, about 100 miles north of Lima. But some years ago Antonio Raimondi, of whom you have heard our President speak this evening, made a thorough examination of the source of the Amazon, and found that just after the little stream called the Marañon leaves Lake Lauricocha it is joined by a much longer one called the Nupe, and therefore he makes the Nupe the real source of the Amazon. Now, with reference to industrial development, it may be well to call your attention to the history of Peru. It has had three or four periods, not of industry, not of true production, but a history such as the old Spanish invaders gave to it up to the time of the War of Independence, and that was the enslaving of about nine-tenths of the population that the other tenth might enjoy luxury and prodigality of expenditure in all directions, and absolutely tearing the country to pieces to work its mines that Philip of Spain and Charles II. might make their wars in Europe. After the long War of Independence, which left the country full of civil hatreds and absolutely desolate, the people could scarcely get a living, until the guano deposits, anciently worked by the Incas, came into the European market. Then came the problem of how to spend the money? Europe wanted the guano, and was willing to pay £13, £14, £15 a ton for it, but Peru must have some reason for capitalizing these guano beds with rapidity—some excuse, in fact, for a great deal of plunder. So they projected four or five great railways instead of irrigating the lands of the western slope of the cordillera, and they pushed these railways up the mountains with 4 per cent. gradients and 350 feet radius of curves, until a locomotive could scarcely haul up a paying load. What was the result? That mules and jackasses could compete with, and in fact even to-day I understand these beasts of burden compete in some parts, with the railways of the Peruvian Corporation. So that when I hear of a new railway that is going up the Huaylas valley to develop its coal-mines, its copper, silver, and other minerals, and its agricultural resources, I hope, I sincerely hope, it will be built with gradients and curves that will eliminate the jackass from the transportation problem. After the guano deposits were exhausted, a kindly nature gave them the desert of Tarapaca with its nitrate deposits. But these attracted the attention of their southern neighbour, somewhat more powerful than they were, with the result that by force of arms they disappeared into the treasury of Chili. Now, that was the greatest blessing that ever happened to Peru. Up to the date when she lost her nitrate deposits, Peru scarcely had ever done a day's work; nobody thought of personal labour, everybody lived on the Government, lived on guano, lived on nitrate. The war with Chili left Peru prostrate, stripped of everything by which she had been living, and then came the necessity of taking off their coats and going to work, and right nobly have they assumed the task. They have bequeathed their old prodigal habits to their southern neighbour, who fosters them

by a large export duty on nitrate, while they themselves have set to work over Peru with its vast, almost untold wealth, and are making a brilliant show of it to-day. I know of no country in South America that deserves greater praise than Peru for the struggles which she has been making since she lost Tarapaca. She has adopted a gold currency, based on the English pound sterling, and has had the good sense to create a decimal system of ten soles to the pound, and then a hundred cents to the sole, which makes it easy of calculation, and does not wear a boy's brain out in the learning. Then, too, the aspirations of the statesmen of Peru evidently are to see these railways, which they built by mistake in bad locations, out of their mess, and extend them to the other side of the Andes. They have sent out many exploring expeditions, and projected numerous railways. They employ engineers of a high standard of excellency, and we ought to encourage them in every way we can. I predict that Peru fifty years hence will be yielding more silver, gold, and copper, and all agricultural products than ever she produced in the time of the viceroys. When Krupp established his works, which have grown to be the pride of the German empire, it is said that he wrote upon the doorway of his humble cottage, "If work bring blessing, then is labour prayer." Peru also seems to have inscribed this motto upon the gateway to her future.

Mr. LEMBCKE: With the courtesy of Sir Clements Markham, you have heard the interesting paper sent by Mr. Enock. I have had the advantage of meeting Mr. Enock out there. He has set an example of British pluck and energy, and his paper quite confirms what I say. In fact, this evening I believe the paper has been more or less from a scientific and historical point of view than geographical, and although there are a good many persons in this room who know a good deal of Peru, I believe there is still much to study. The position of Peru is being developed in a most interesting way. Surveys have been made for the purpose of establishing communication between the Pacific ocean and the majestic system of river navigation of the interior. It may be stated that about 20,000 miles of navigable river exists. A railway is going to be built from one of the northern ports of the Republic towards the nearest navigable river, and I believe once the Panama canal is opened and this railway built, there will be no other country more attractive for emigration than Peru. As has been said to-night, the country produces all the products known. I seize with pleasure this opportunity to thank Sir Clements Markham as the President of the Society, and personally for all the kindness he has bestowed on my country, and I say the same of Colonel Church for the kind words he has spoken. That is all I have to say.

The PRESIDENT: I should like Sir Thomas Holdich to draw a parallel between the Patagonian and the Chilian Andes and the cordilleras nearer the equator, in a few words.

Sir THOMAS HOLDICH: I regret very much that my travels have never carried me quite so far as Peru, so that I am unable to speak from personal experience. But there were one or two points certainly in Mr. Enock's paper which attracted my attention, particularly with reference to the climatic conditions of that country, as evidenced by the desiccation which is now prevailing there. It seems that there is very little difference between the Andes of the north, the Peruvian Andes, and the Andes of the south in this particular. Everywhere we find precisely the same evidence of receding snowfields and the gradual diminution of glaciers; and this does not prevail only, as you probably know, in America, but it would appear that this channel that we have heard of to-night is but one link in a long chain of evidence pointing to a general drying-up of the whole of the northern hemisphere. And this to me makes it all the more astonishing that there should have been a race of people living in Peru, about whom we have heard

a little to-night, who have left such evidences of their remarkable ingenuity and their great strength as builders, but of whom otherwise we know very little; that such a people should have been at the zenith of their power at the time when the climatic conditions of that country must have been severer certainly than they are at present. It would interest us very much to know, I think—possibly our President can tell us—who are the lineal successors of those people in South America. It is a curious fact that they show, in their remarkable capacity for developing agriculture by means of irrigation in almost impossible places, a great similarity to certain Asiatic races, who have, through all history, evidenced the same capacity. We know that Chinese, Afghans, and Persians alike, all of them, could teach us more than we know at present about the art of irrigation; and the Incas seem to have been quite as much masters of that subject as the Eastern nations, but we find no sort of evidence of the same capacity amongst any of the races of Africa. Colonel Church has favoured us with something of the recent history of Peru; but his history did not carry him far enough back to tell us who we might expect to represent the race of Incas at the present time in the American continent. I know something of the Araucanians of Chili, and something of the Indian people on the Argentine side of the Andes, but amongst them all, there are no people who could ever have risen to such heights of civilization. They are incapable of developing such intelligence as has been shown by those who built the wonderful fortresses and buildings of which you have seen pictures to-night. The Incas seem absolutely to have disappeared. There is one other little point which Colonel Church made as regards Peru. He said that the loss of the nitrate fields was the making of that country, or something to that effect, I think. He will not be surprised to hear that that sentiment is echoed further south. I have heard it said by Chilian gentlemen of light and leading, that the worst thing that ever happened to their country was the acquisition of those same nitrate fields. "We were once," said an eminent statesman to me—"we were once poor, but honest; now we are a little better off, but our political honesty is not so certain." It is a curious fact, perhaps, that what would be reckoned by the world in general as the acquisition of wealth should have led to such results. As regards the extraordinary amount of mineral wealth to which Mr. Enock has pointed as existing in those mountains, we see that the development of it entirely depends on communications being opened up. That, I may say, is precisely the same all through the more southern countries of Chili and Argentina. Communication and the means of transporting material is what they all cry out for. I am surprised to hear what Colonel Church has said about a certain railway of Peru. But I think we may assume that railways with which the jackass can compete are not likely to be built in future in the South American continent, and it is the development of such communication which will undoubtedly lead to the development of the wealth of these countries. But before they can build their railways it is necessary that they should know their country, and that, whether we deal with Peru or Argentina or Chili—that is, I think, really the great want in their programme. They are ready to carry out their public works before they know their geographical conditions. And so we come back to the same old tale, that it is necessary to begin with maps and map-making and scientific explorations. In future, I hope those who leave this country, whether it is for exploiting mineral wealth or any other purpose, will carry with them both the knowledge and the means necessary for adding generally to our geographical information.

Sir CLEMENTS MARKHAM: I am afraid that at this hour of the evening I cannot be expected to enter into any question in regard to the supposed disappearance

of the Inca race; but I may say that my own conviction, telling it you very briefly, is that there was a great monolithic-building people in far distant ages who created a vast empire, that there intervened a very long period, that some of the old race rose again, gained power, and that the modern history of the Incas is the history of a higher race, which, I believe, came from the far south—of a higher race ruling very populous and inferior tribes. The Inca people have by no means disappeared. But, to return to geography, I wish to point out to you what a very remarkable feature of the Andes this long natural valley presents. On one side of it you have what is called the black cordillera, not rising so high as the snow limit, but I believe that in the mines of that black cordillera you would find the water frozen to a considerable depth. And there is another feature which I am given to understand is met with in this long lateral valley, which is that the snow-level on the western side is much lower than in any other part of the equatorial Andes, and this is accounted for by the fact that the black cordilleras in this part, which is nearly 100 miles long, is unbroken by any river. There is no opening in it, and the consequence is, no warmth comes up from the coast, which is the case in other parts of the Andes, and therefore the snow-level on the opposite line of mountains is lower than in any other part of the equatorial Andes. I cannot help wishing, after listening to what has been said, about this famous range of mountains, that we could institute a close and thorough investigation into the Andean system; that we could tell off, say, five or six of our most eminent geographers to undertake certain parts of the Andes, to examine their history and all that is known about them, and to explain to us fully the system in each section that they may undertake. I would take first, say, from the equator to the river Santa; then this part that we have been considering to-night, from the river Santa to the north of Cerro Pasco; next the division from Cerro Pasco to Vilcañota. Another geographer might undertake the basin of Lake Titicaca; and then we should call upon Sir Thomas Holdich to take the rest of the Andes down to Graham Land. I shall try in the future to see whether such a geographical investigation cannot be organized. But we must now pass a cordial vote of thanks to this enterprising young mining engineer, Mr. Enock, for the valuable communications he has been so good as to send us, and for the photographs and drawing which accompany them, and which will all be printed more fully in the *Journal*.

THE IDEAL TOPOGRAPHICAL MAP.*

By Major C. F. CLOSE, C.M.G., R.E.

THE topographical maps considered in the following brief paper are those of which the scales vary from $\frac{1}{25000}$ to $\frac{1}{250000}$, or roughly, from 2 inches to 1 mile to 4 miles to 1 inch. And it is not proposed to discuss field precedure or survey methods, but only to consider the printed map.

A topographical map should possess the following qualities:—

1. All the information which it presents should be accurate.
2. It should present as much information as possible.
3. The information should be presented as intelligibly as possible.

* Research Department, December 15, 1904.

The first quality, that of *accuracy*, mainly depends upon the methods used in the field, and in this respect the government maps of most civilized countries can hardly be improved upon. The point is, moreover, one upon which all are agreed, *i.e.* that the field methods must be such that there shall be no plotable error on the printed map. But when we come to conditions 2 and 3, we find some divergence of opinion and practice.

The *amount of information* which can be shown and the selection of the information to be shown are two aspects of the same question. The insertion of unnecessary matter may harm a map considerably; as instances of this we have the parish boundaries on the Ordnance Survey engraved 1-inch, and the signs for cultivation on the Spanish $\frac{1}{500000}$. But the opposite defect is far more common, viz. the omission of useful matter. The most common fault, perhaps, is the want of numbered heights, and the next most common fault is insufficiency of names. As illustrations of the former defect may be quoted some Indian topographical maps, on which an abundance of heights are shown on the tops of the hills and very few in the valleys. Another common omission is that of essential details in the hill features, caused by a too rough generalization in the process of reduction from a larger scale.

Another defect, frequently met with in maps on scales of $\frac{1}{125000}$ and smaller, is the omission of minor roads and tracks. This is sometimes a serious mistake. It is often better to crowd the sheet with all the roads there are, rather than produce an easily read, simple, but misleading map. It is, however, clear that the whole matter of the selection of information to be shown on a map is mainly conditioned by two factors —the scale of the map and the character of the country; a statement which may be put in the form of a truism, viz. that, given the amount of information required, the scale of the map will depend upon the closeness of the detail. Thus, a 2-inch scale for Jersey is equivalent to a 1-inch for Kent, a $\frac{1}{2}$-inch for South Africa, or a $\frac{1}{4}$-inch for certain regions in tropical Africa.

It is, perhaps, possible that a class of map might be devised which would show the main features at a glance, and the minor features by means of a magnifying-glass. If we imagine a glass to be used with a power of 2, we could put as much information on a $\frac{1}{2}$-inch map as we now find on a 1-inch map. There would certainly be great difficulties in printing such maps in colour, and simple reduction will not produce the required effect. But, though the attempt might result in failure, it would be worth making. From an army point of view, anything which reduces the bulk of the maps which have to be distributed and carried is to be encouraged.

Almost all Government maps are published with wide margins. These margins are only useful for holding the map by. They might be utilized for presenting additional information. This might conveniently

take the form of photographs likely to assist in conveying clear ideas of the surface features, especially of the vegetation, or of special objects and landmarks likely to help in identifying positions. Engraved views have long been the accompaniment of the Admiralty charts, and the same principle might usefully be adopted for topographical maps. It is, of course, not suggested that a map should be garnished with photographic "tit-bits" of local scenery. No photograph should be printed which is not typical and characteristic, or likely to be useful to a traveller. The photographs would be printed from "process" plates.

The quality of *intelligibility* depends more upon the use of colour than upon anything else. It may be taken as generally accepted that a topographical map should be printed in colours; and, further, the following colours are almost universally employed :—

Blue for water, green for woods, brown for contours, and black for lettering and for the graticule. Shades of brown or grey are commonly used for the representation of hill features on the layer system.

Other matters which affect the intelligibility of a map are—

The shading of the hill features.
The contour interval.
The lettering.
The bearing of the edges.
The conventional signs.

Unless the contours are very close together, the addition of *shade* much increases the legibility of a map. (Vertical hachures do not combine very satisfactorily with contours.) The depth of the shade should vary with the steepness of the slope, and should not depend on any imaginary direction of the incident light.

Examples of the combination of contours and vertical hachures are the Ordnance Survey 1-inch, the German $\frac{1}{100000}$. Examples of the combination of contours and shade, depending on an imaginary direction of the incident light, are the French colonial $\frac{1}{50000}$ and an edition of the Swiss $\frac{1}{50000}$. There is no satisfactory example of the best system, *i.e.* the combination of contours and shade varying with the steepness of the slope.

As regards *contour interval*, the following table will serve to give an idea of what may be considered the normal contour interval. The number in the right-hand column is found by multiplying the contour interval in feet by the scale in inches to the mile.

TABLE OF EQUIVALENT CONTOUR INTERVALS.

	Equivalent in feet on a scale of 1 inch to 1 mile.
The United Kingdom, 1 inch to 1 mile	100
" " ½ " 1 "	50
Ordnance Survey colonial maps	50

		Equivalent in feet on a scale of 1 inch to 1 mile.
France	$\frac{1}{80000}$	52
„ colonial	$\frac{1}{50000}$	41
Germany, Prussia ...	$\frac{1}{25000}$	41
„ Baden, „ Bavaria, „ Wurtemberg	$\frac{1}{25000}$	81
Italy	$\frac{1}{50000}$	20
„	$\frac{1}{100000}$	102
Spain	$\frac{1}{50000}$	81
United States	$\frac{1}{62500}$	50
„ „	„	20
	Mean	57

We may therefore say that the weight of authority is in favour of a contour interval of about 50 feet for a scale of 1 inch to 1 mile, and for other scales in inverse proportions; thus, 100 feet for a $\frac{1}{2}$-inch map, 200 feet for a $\frac{1}{4}$-inch map, and so on.

A similar result would have been arrived at on the merits of the case. Every one who uses the 1-inch Ordnance map knows that the contours are not sufficiently close to show the hill features clearly in ordinary country. It requires a very steep slope for contours at such a wide interval to attract the attention they should.

This rule need not be considered as applying to very mountainous countries, such as Switzerland. The Swiss Federal maps have the following intervals:—

$\frac{1}{25000}$	... ...	10 metres, equivalent to 82 feet for a 1-inch scale.
$\frac{1}{50000}$	... ...	30 „ „ 123 „ 1 „

Lettering.—Nothing has so far equalled engraving on copper for clearness. Transfers from copper to stone or zinc give results nearly as good. Next to these comes handwriting on stone or zinc, or heliozincographic prints from manuscript; and the worst method of all is typing. This remark about lettering applies also to contour and detail; if fine work is required, it is best to engrave on copper for subsequent transfer to stone.

The Bearing of the Right and Left Edges of a Map.—It is of considerable assistance, in using a map, if the right and left edges are north-and-south lines, *i.e.* the map should be bounded by meridians. Many national maps fail in this respect; for instance, the Ordnance 1-inch, $\frac{1}{2}$-inch and $\frac{1}{4}$-inch maps are truly rectangular in shape, and the edges are not meridians. In the extreme eastern and western sheets the inclination of the edges to the true north line amounts to about 4°. The same defect occurs in other national maps.

Conventional Signs are undoubtedly an evil, but they cannot be dispensed with entirely. On certain foreign maps (for instance, some French maps) they are far too numerous. As a general rule, the more pictorial a conventional sign is the better. Thus, a windmill should

look like a windmill, and a wind-pump like a wind-pump. Railways should be given cross-bars. The different classes of roads should be distinguished conventionally.

Minor matters affecting the usefulness of a map may be briefly mentioned. The scale, even when metric scales are used, should be expressed in terms of two units—one on the map, one on the ground. Thus in addition to the statement that the scale is $\frac{1}{100000}$, should be added the words, "1 centimetre to 1 kilometre." When there is any chance of a colony adopting the metric system, the American compromise $\frac{1}{62500}$ should be used instead of 1 inch to 1 mile, and $\frac{1}{125000}$ instead of $\frac{1}{2}$ inch. The magnetic declination should be mentioned for the date of publication, and its annual variation given.

A map should be of moderate size, about 18 inches square, and when intended for use out-of-doors, should be mounted on linen and folded. The Ordnance coloured 1-inch maps are very convenient in these respects.

If the various national maps are criticized on these lines, they can be arranged in groups somewhat as below—

First-class maps—Ordnance Survey, coloured 1-inch.
Swiss, $\frac{1}{50000}$.
French colonial, $\frac{1}{50000}$.
United States, $\frac{1}{62500}$.

Second-class maps—German, $\frac{1}{100000}$.
German, $\frac{1}{25000}$.
Spanish, $\frac{1}{50000}$.
Russian, $\frac{1}{126000}$ (Balkan peninsula).
French, "Carte Vicinale."
French, $\frac{1}{80000}$.

Also Austrian, Italian, Danish, Belgian, and Roumanian maps.

It is not intended to imply that the above is an exact classification; such an arrangement must depend a good deal on individual taste and preference. Indian maps, of which the field work is so admirable, would, on account of the roughness of the reproduction, occupy a place below all those quoted above.

It is clear that, as the field of exploration narrows, this Society must devote an increasing amount of attention to mapping and topography as opposed to sketching and exploration. We should have our own standard of excellence in cartography, and the standard should be a high one. It is suggested that the Research Committee should recommend to the Council the expenditure of a sum not exceeding £100 in the production of a topographical map of a high degree of excellence, to serve as a guide for, and be used as a standard by, the Society.* This

* Better still would be a series of maps on the same scale depicting the same tract of country in various styles and on different systems.

typical map would be most useful in the settlement of cartographical questions which arise in all parts of the Empire—such questions, for instance, as were discussed at the recent Survey Congress in South Africa, or which arose in connection with the proposed Survey of Canada.

It would also serve as a standard for candidates for the Society's diploma.

Colonel JOHNSTON: I think Major Close's paper has been an excellent one. It deals in minute detail with a large number of more or less matters of opinion, and on the whole, I think, very fairly and very well, but there are a few points on which I do not quite agree.

In the first place, he mentions it as a very common fault that maps should show too little detail, too few names, and so on. My own feeling is that, as a general rule, the tendency is rather the other way. Of course, I quite admit some maps do show very little detail, but on the smaller-scale maps, reproduced by reduction from the larger scales, the tendency is to try to cram into the smaller scales everything on the larger. In entering this room I noticed some Japanese maps which exemplify this tendency; the $\frac{1}{200000}$ is a well-executed map, but on the smaller-scale map, $\frac{1}{1000000}$ I think, reduced from it the names are too numerous. Again, although hill features are often omitted, it is a common thing, in the case of engraved maps, to find small features over-shown, with the result that the main features are not brought out so thoroughly as they might be.

With regard to the proposal of Major Close about having pictures on the margins, it appears to me the main object of margins is to make the map look better. It is more or less a matter of opinion, but if you have pictures on the margins you rather do away with that. I suggest it would be better to cut the margins off if they are not needed for their present purpose.

As regards the question of colouring maps, I quite agree that for utilitarian purposes the introduction of colour has made a great improvement, and it is now very generally adopted; but I would certainly hardly like to rule out the black and white map so completely as Major Close has done. The Swiss Dufour atlas is probably as beautiful a specimen of map-making as you could find anywhere. Some of the 1-inch Ordnance sheets are also very good specimens, and I should hardly like to have them entirely put out of court. The Swiss, of course, as we know, have gone to colour printing, and their $\frac{1}{50000}$ is a very good example of colour-printing, but hardly so beautiful a map as the Dufour atlas.

I don't quite agree with Major Close when he says the depth of shade should vary with the steepness of the slope. The range that one can get between the darkest possible representation of hills and the lightest is hardly enough to cover any except very great differences of slopes, and my belief is that the best method of representation is contours, combined with shading as shown in the present Ordnance Survey 2-mile maps.

I quite agree when he says contours on the 1-inch Survey maps are not sufficiently close for topographical maps on that scale. It would be much better if they had been at 50 feet instead of 100. Unfortunately, the Survey contours are ascertained with great accuracy at great expense, and I am afraid the cost of the additional contours which he would like to have, and which I should very much like to see on the maps, would be prohibitive.

With regard to the lettering, I agree that good writing is better than typing, but I am afraid I am not prepared to condemn typing in the way he does. As

a matter of fact, nothing comes up to really good writing, especially when the writing is small. The larger the character the better typing compares with writing. When you come to maps reduced by photographic means, I believe typing is as good as any means that can be employed. First-class writers are not very easy to get, and the advantage of typing is that you get uniformity, which you cannot get in writing.

Major Close also mentions that he considers maps intended for use out-of-doors should be mounted on linen and folded. Well, I agree as to their being folded, but as regards being mounted on linen I am not quite so clear. We have introduced recently in the Ordnance Survey a new method of folding, and my belief is that unmounted maps folded in this way are almost better than maps that are mounted. They take up less room, they don't go at the edges, and any part of the map can be read without unfolding the whole. Therefore in their case I don't think there is any advantage, except for very rough work, in mounting on linen. If you wish to get an ideal map for working in the roughest weather possible, I think the only thing is to mount in sections or print on Japanese paper and waterproof. The latter is a beautiful printing paper, and is practically untearable, but it takes wet badly. If you waterproof it, the objection as to its suffering in wet disappears, and you get what I consider a very good map, but unfortunately a rather expensive one. We prepared in this way a number of maps for the manœuvres two years ago, where they had a good deal of wet, and I believe they answered very well.

As regards Major Close's suggestion that the Royal Geographical Society should give a sum of £100 for experiments, I cannot agree; I think the Royal Geographical Society can find better means of spending its money. I think you can safely say that all persons and firms making maps and dealing with them are doing all they can to improve the methods of reproduction, and I do not think the offer of £100 would do very much to further improvements. Moreover, I consider a map must be designed very largely with reference to the kind of country which it is to represent. For instance, I do not consider the style suited for a closely populated country like England would be suitable for a hilly and sparsely populated country like South Africa. To take one example, you find in the American methods a beautiful sample of map where ground forms are shown by close contouring, the same as in the Japanese maps. If you come to a country like Holland, I don't think that would answer as well. I think discussion is likely to do as much good as making experimental maps, and that the Royal Geographical Society would not benefit cartography by trying to lay down a standard. If the Royal Geographical Society take a different view of the matter, the proper authorities will probably have no objection to the experiment suggested on the map of Jersey or St. Helens.

For obvious reasons, I have referred mostly to points on which I differ from Major Close; but while I differ on a few points, I agree in many, and consider that his paper is a most valuable one.

Major Hills: I should like to offer a few remarks on the very excellent paper we have had. I may, first of all, express my agreement with most of the points advanced by Major Close, and our differences are only in very minor points. He says, first of all, in speaking of the accuracy of a map, that all details should be accurate. It would be rather an interesting thing to discuss how we are to distinguish between the accurate and the inaccurate details of a map, because, of course, when we are dealing with maps produced from organized surveys, there is no want of accuracy; still, a large number of the maps we have to deal with are not so produced, and it would be useful if we could get any idea—I have never heard of any practical suggestion—as to some convenient method of

distinguishing what is absolutely fixed and what only depends upon inaccurate or hearsay evidence. The point raised by Major Close about the heights only being shown at the tops of the hills had not occurred to me before, but certainly it seems an extremely common defect. Of course, when one thinks of it, the heights of the valleys are just as important. The omission of essential details in hill features, caused by undue generalization in reduction, seems to me rather a survey question—that is to say, what it means is that it is of the utmost importance that the original survey should be made on the same scale as the final map; in other words, any generalization should be made, not by a draftsman, but by a man who has actually seen the ground and knows it. I don't think I can follow Major Close in his suggestion to print the minor details of a map so that it could be read through a magnifying-glass. It would be quite possible, of course, to reduce a map to such an extent so that it could only be read by a magnifier, and if on any occasion where lightness of transportation was of very great importance, it might be quite possible to make a map by photographic reduction which could be only used by using a magnifier of the power of, say, 10. But maps can now be produced so light, especially with these specimens Colonel Johnson has shown, that really the question of weight is not such a very important one. The suggestion to print photographs on the margin does not seem to me to be a very practical one. Major Close talks of the Admiralty charts, but I think he overlooks the fundamental difference that in the chart the important thing for the mariner to see is the appearance of a certain sea-port or headland from the sea. There is nothing equivalent to that in a map covering an ordinary area of land. If anything were to be put in the margin, it might possibly be plans of the towns, which must be shown in a very conventional way on a small scale. The representation of hills is the subject which will invoke most discussion, and it is very difficult to get any agreement on the question, but I think we may agree with Major Close that the combination of hachures with contours is not a good one. I think we may say that in the 1-inch Ordnance Survey coloured sheets the hachures really add nothing to the legibility of the map. I am not quite certain whether I agree with Major Close about whether the shade should follow the slope or whether it should be a conventional one. I should like to see his specimen-map first. One very important point is a practical question which I should like to ask practical people, and that is as regards the method of shading, the actual method by which the shading is to be drawn on the map. I should like to ask Colonel Johnson about that particularly. Of course, in the old days, it used to be drawn on a stone direct by the draftsman, and it was quite a laborious process. Now, on the half-inch Ordnance Survey maps, it is done with a process block from a brush original; but I cannot admit that the shading on the half-inch Ordnance Survey maps is sufficient to add to the legibility of the map. For instance, look at that map of North Wales, which is, as we know, a mountainous and diversified country. Seen from a little distance, the shading only gives the appearance of a flat tint with a few dark patches; it does not really show up the features of the ground, which is the only justification for adding the shading. The St. Helena map is quite a different sort of example. Looking at that from a distance, it shows up the main features of the ground very well. The suggestion of Major Close, that the Society should undertake the production of a model map, seems to me a very good one. But there is so much difference of opinion that I think it would be hardly sufficient for the Society to produce one map; it would have to produce five or six in different styles, and then let us see them, and we could have another discussion on the subject.

Mr. Douglas Freshfield: I feel as a mere amateur some diffidence in

speaking in the presence of so many professional map-makers. My remarks will not be in the sense of criticism, but mainly in the sense of appreciation of the excellent work done by the Survey. I think the Society may fairly congratulate itself on the adoption of a method it strenuously advocated—the use of colours. I do not say the universal use, because I entirely agree with the Director of Surveys on this point. I am sure that the new maps will be appreciated by the public. With regard to the question of how contoured maps should be coloured, whether the depth of the shade should correspond with the steepness of the slope, I cannot agree with Major Close. About fifteen years ago a new issue of beautifully contoured maps, called the Siegfried Atlas, was made in Switzerland. It did not give satisfaction; it was found that the public did not read it easily, and various experiments were made, of which I see one here, with a view to making the contoured maps picturesque by colouring them. From my point of view, contours give the kind of information we want for scientific use, and you put in the colouring for another purpose—to enable the average middle-class man to read the map easily. The preferable method, therefore, is that which best secures this end. I confess that until I have seen a satisfactory map produced in the way Major Close suggests, I shall lean to the artistic mode of colouring, which is intended, not to repeat, but to supplement the information which is adequately given by the contour. I feel some doubt as to the desirability of what has lately been done in one of our Ordnance maps in colouring the woods green. It may be valuable for military purposes, but for general purposes, I think it rather destroys the picturesque legibility of the map; it makes it look spotty at a distance, and, so far as I can judge, you only get approximate accuracy with regard to the woods. That may be partly owing to the constant destruction of woods. With regard to what is said about the quantity of names, I think there is another still more important question, and that is their selection. I know selection is difficult, and I appreciate the pains taken with regard to the retention of characteristic names. Then with regard to the distinction of roads, I notice in the new maps they are divided into three classes. I am curious to know what principle this classification is based on. In France the first-class road would be the Route Nationale, the second would be the Route Departmentale, and the third the Route Vicinale. But I cannot make out on what principle it is done in England.* In the old maps the distinction between roads was one of the greatest defects; the new maps are improved. Again, I do not know whether I am quite in order in mentioning it here, but I cannot help feeling, as we are met to discuss maps, that we ought not to pass without mention their defective distribution. The clumsy and unpractical way in which the Post Office has taken in hand the distribution of Ordnance Maps is a misfortune. Perhaps some scheme might be introduced to improve the distribution. The present Director has done so much that I cannot help hoping he will succeed in this matter also. With regard to the suggestion that the Society should spend £100 in making a model map; I quite agree with the reasons given to show that it would not be a very desirable use of the Society's money, and I doubt if the sum suggested would produce anything useful. As the Director of Surveys has said, I think we may leave it to the people who make the maps to go on experimenting, and that if we produce a typical map, we shall probably within the next five years want to alter it again.

Mr. Bolton: I should like to remind Major Close that a combination of contours and shade varying with the steepness of slope has already been tried. Some thirty years ago a map of Jerusalem was engraved for Murray's Ancient

* I have since been informed it is on the width of the roads.

Atlas. The Ordnance contours were used as a foundation, and a very careful arrangement of hachures according to a strict scale was drawn upon them, and the map engraved. I think if he were to try a combination map of that sort he would find it very successful. But, as has already been said, such a map is too expensive for the private publisher to undertake. A standard map is, I think, impossible; £100 wou'd only produce a few inches. An ordinary 1-inch Ordnance sheet costs something like £500. And after all, is there anything better than an engraved ordnance sheet?

Dr. Herbertson: I should like to thank Major Close for introducing this subject. He seems to me to have looked at the map too much from the point of view of the military man, who wants as much detail as possible. I often want names and roads and boundaries, which interfere with the clear representation of the surface features, eliminated from the map. At the present time the 1-inch sheets are printed from at least two plates, one containing the names, the rivers, the roads, and other features, and the other plate the hill-shaded plate, with spaces left for the names on the first-mentioned plate. I think a very considerable service would be done if those two plates were slightly modified, and if on one plate we had the coast, the rivers, the contour-lines, and the hill shading, and on the other the names, roads, boundaries, and other details—that is, the permanent physical features would be represented on one plate, which could be printed and studied separately, while for those who wished to read the names and other details the map could be produced, as at present, from two plates. Perhaps an even better way would be to use an ordinary paper print for the feature lines, and to print the names and roads and other symbols on transparent paper, which could be fitted over the configuration map. Of course, other distributions could be printed on tracing-paper in the same way. It seems to me important that, in addition to having the contours close enough, they should be at regular intervals. At the present time the Ordnance maps cannot always be used for the comparison of slopes without calculation, because the contour intervals are not uniform. I think we might quite well adopt the American plan of having a closer contour interval of 20 feet in the plain, and of 50 feet or 100 feet in the hilly parts of the country. The use of close contouring in geographical investigations has been very well shown in the work of Prof. Kendall on the 'Glacial Lakes of Cleveland, in North Yorkshire.' In connection with the specimen maps, I am sorry not to see the $\frac{1}{200000}$ French map and the $\frac{1}{100000}$ of Southern Germany, which I think ought to have been in the list of first-class maps. I think that making the margin meridians is a very bad plan, because if you want to look at many sheets at a time, which I constantly have to do, it is very difficult to make the sheets fit. It would be much better to make the sheets rectangular, fitting at the bottom (in the northern hemisphere), or else in the middle, and repeating a roughly triangular part on the next sheet. I think if we are to have an ideal map made, the island chosen might be the Isle of Man, with its contrasting plain and highland, the Isle of Arran, or even the Isle of Wight.

Dr. Dryer: I do not think I can say anything with authority on the subject, not having paid special attention to it. I am most accustomed to the contoured maps of the United States Geological Survey, which seem to me to be very clear, and to fulfil all the functions of a topographic map. Since coming to this country I have become more familiar with maps of other kinds, and I see some advantages in them over the strictly contoured map, the principal one being their graphic character. The objection to the purely contoured-map is its want of graphic character and the inability of the ordinary person to read it. But I find, as a teacher of geography, that it is necessary for most persons to learn to read any

kind of a map; even the simplest map is not read spontaneously, and I do not think that it is more difficult to teach a person to read a contoured map than any other. I do not know that I can add anything of value to this discussion. I will only express my preference for the contoured map for showing relief.

Captain RUSSELL-BROWN: I only wish to make a few remarks on two points. The first is the question of reduction of maps by photography. I have a specimen of the new Ordnance Survey $\frac{1}{100000}$ map of England, which has been reduced by photography to a quarter of its size. All the names on the reduction are legible with the help of a magnifying-glass with a strength of about three. It seems to me that such reductions would be useful as key maps for military purposes. The other point I want to raise is a question on which there seems to be much difference of opinion, perhaps more so than on anything else connected with the reproduction of an ideal topographical map, and that is the best method of representing hill features. If you look round the maps on the walls, you will find a Swedish map which clearly represents the hill features on the "layer system." This, in my opinion, is the best way of showing hill features on small-scale topographical maps. I think this method is suitable for maps on a scale of 4 inches to a mile and under. A point about this Swedish map, which seems capable of improvement, is that all the hill features might be printed together from one copper plate or copper transfer, instead of requiring something like half a dozen plates. On this system, the Ordnance Survey ¼ inch to 1 mile maps of England and Wales would require about seventeen different gradations of colour to show all hills at contour intervals of 200 feet. There is a specimen on the table of this so-called "layer system" of reproducing hill features, showing something like thirteen or fourteen different gradations of colour reproduced simultaneously from one copper engraving. I agree with Mr. Reeves that this "layer system" could be improved by graduating the colours between each successive contour, so as to avoid giving the impression of steps to the slopes.

Mr. GEORGE PHILIP: In the preceding discussion I think, with Dr. Herbertson, that too much stress has been laid upon military requirements in a topographical map. But the scope of an inquiry like this is to find out what is for all purposes the ideal topographical map, and as regards this I think a solution has not been arrived at. If we banish the question of expense of production, which so largely handicaps the private publisher, there is no doubt that the use of colours makes for the beauty and value of a map. And if, in addition to the colours advocated by Major Close, we combine tints, contours, and hachures, we can obtain a still more graphic effect. To my mind a perfect topographical map would be a kind of picture in which the elevations would be shown in detail by hill shading, the relative height by contour-lines (which when used by themselves are apt to ignore incidental surface features), and the absolute height above sea-level by a system of tinting in "layers." I do not think such a combination of flat tints, contour-lines, and hill shading has been sufficiently emphasized; it seems to me it would give the most perfect result. In conclusion, I cordially agree with what Mr. Freshfield and Mr. Ravenstein have said on the question of educating the public. The general public expects the price of maps to be so low, that the production, by private enterprise at least, of really good and valuable maps printed in a number of colours becomes almost impossible.

Major C. B. SIMONDS, R.G.A.: I think no opportunity should be lost in affording information by styles of printing and use of colours, of which in English maps full advantage is not taken. For instance, following logical reasoning (for simplicity), nothing in nature being bolt upright, upright printing should only be used for everything artificial—the work of man's hands—names of towns, villages, buildings,

railways, roads, etc.; while, the natural slope of printing being to the right, names of mountains, forests, rivers, plains, etc., should be in type sloping to the right; and peoples, tribes, tribal districts, parishes, etc., in type sloping "back-hand," to the left. As to colours, where employed, heights of hills and contours should be in brown; heights of rivers across them in blue (at normal water-level or mean tide); anything artificial, roads, railways, bridges, etc., figures in black. Complete absence of artificial effect is imperative; the beauty of the ideal map must be beauty unadorned.

Major Hills: I should like to make another remark or two. Dr. Herbertson was talking about the separation of the natural features on the map from the artificial features. That is one of the points of printing a map in colours. If, for instance, the hills are printed in brown, and the water in blue, and the detail and names in black, by printing only the blue and brown together you get a representation of the land and its surface features. A good deal of obloquy has been thrown on the British public in this discussion. They have been described as not using maps, and not being interested in them. I think that might have been very true ten years ago, but I doubt if it is the case now. I think if you went to, say, the Lake District, you would find just as many maps used as at Chamounix. I am sure, if the Ordnance Survey could arrange to put their maps on the railway bookstalls, they would have an enormous sale, especially for the half-inch maps. The question that has been raised as to representing slopes in different layers rather emphasizes what I said before about the necessity, if we are going to have a specimen map, of having two or more. Major Close proposed a system by which the steepness of the slopes was represented by the darkness of the shade. Now, here is a proposal by which the depth of shade depends on the height above sea-level; they are both consistent systems, and which has the advantage is a question of taste.

Mr. Reeves: I have listened with great interest to Major Close's paper and to the discussion that has followed, and think we ought to be obliged to him for re-directing our attention to this most important subject. I say re-directing, for it is a matter which, as most of us are aware, has been for a long time under the consideration of the Society, and I remember quite well, about fifteen years ago, a special committee being formed to deal with it. One of the many valuable results of Dr. Scott Keltie's 'Report on Geographical Education,' which appeared about that time, was to create a fresh interest in topographical methods, and since then the matter has not been lost sight of. It is, therefore, not a new subject to us. Personally I should very much like to see a specimen topographical map prepared, as it would be useful to me for instruction purposes. I could hand it round and show pupils what is required, and the sort of map that would be expected from them. The cost would naturally depend upon the method of production, but I doubt if £100 would be sufficient; however, I think it would be a good thing if it could be done. There are many points in Major Close's lecture I should have liked to have said something about, and several things I intended to say have been said already. The representation of the hill features is one of the most important matters. We are all well acquainted with the various methods shown on the different maps on the screens around the room. The layer system of tinting and contours is valuable for some purposes, but in many respects it is far from satisfactory. It always gives the impression of a country consisting of a series of steps or terraces, which, as a rule, is not in the least true to nature. Then, again, the tints are very often far from what they ought to be. It appears to me that if we are going to adopt this system at all we should use gradations of tints of one colour only, and not two or three different colours. For instance, I feel sure it is a mistake to jump suddenly

from green to brown. Such an abrupt transition is incongruous, to say the least, and without any change in the natural features to warrant such an abrupt change in colour. I have often known persons unacquainted with such maps to be misled by this sudden change in colour, and it certainly has a way of suggesting that where the green terminates is the limit of vegetation, in spite of any explanation of the tints which may be printed on the map. For ordinary purposes perhaps the combination of shading with contour-lines might be recommended; the contour-lines should show the difference of height with all the scientific accuracy required, and the shading ought to give the graphic effect. Doubtless for general purposes it is best to assume the light to fall vertically and the shading to increase in intensity with the slope, but I do not quite agree in condemning the oblique method altogether, for there are occasions, especially in mountainous regions, when this method gives a far better effect than any vertical lighting would do. Of course, the drawback to the oblique method is that it tends to give an erroneous impression of relative slopes, but this is greatly due to the fact that it is often overdone, as is the case with several of the maps before you. Whenever the system is adopted it should be combined with carefully drawn contours, which would prevent any one being misled. As to making use of the margins of the maps, I have often thought that there are times when they could be utilized with advantage, especially when space is a consideration. In addition to characteristic views, as suggested by Major Close, why not give vertical sections across the country in different directions upon them. There are many other points I might mention, but time will not permit. As to the method of folding so as to make the best use of space for tourist or military purposes, I had recently brought under my notice a suggestion, which seems very good. This consists in an ingenious system of mounting sections of the map upon the back so as to give the continuation in any direction by simply folding over. The idea can be seen from the map which I now place before you. It should be explained that the maps upon the screens are merely those referred to by Major Close in his paper, and no attempt has been made at a complete exhibition of specimens of topographical maps.

Captain Creak: I have a small question to ask, but it is, however, an important one. Major Close says, "the magnetic declination should be mentioned for the date of publication, and its annual variation given." He has taken as an ideal island the island of St. Helena. Well, what declination could he give there, because its value varies in every part? All islands are similarly affected; in fact, wherever you go on land you will find local disturbances of magnetic declination from the normal value. I therefore suggest that the normal magnetic declination or variation should be given on maps, and instead of the words "annual variation," the annual decrease or increase. I think these are important for a map, and in regions where the magnetic declination is largely disturbed, a note to that effect should be given.

The Chairman: Before asking Major Close to reply to some of the criticisms that have been made, I should like to make one or two remarks. We have covered such a wide area this afternoon in our discussion, that it almost seems as if we had room enough for another afternoon's discussion on this subject. The discussion so far has only really referred to what may be called finished topographic maps. But there is a great deal to be said about maps which are not quite so complete as those you see on the walls around you. Major Close begins by stating that one requisite in a map should be that all the information it presents should be accurate. Nobody disagrees with that proposition, I am quite sure, but it is impossible sometimes to carry it out. The question is, when you have a map made up of material which is not homogeneous, some of which you know to be

inaccurate, but which at the same time represents country which is entirely new and has never been mapped before, what are you to do? Of this class are many maps of most important tracts of country extending beyond the frontiers of India. It is impossible to say of them that all the information contained is of equal value. It is most difficult to combine all sorts of material in the map so that there shall be no mistake as to what the actual value of any one part may be. I am inclined to agree with the remark made by Dr. Dryer, that some of the American maps as nearly approach to the typical topographical map as possible; but I have also a very great admiration for certain Swiss maps. As regards the representation of hill shading, there is just one method which I think no one has referred to, and which is the method which we have adopted in India after very many years of trial and experiment, which is found to answer best in the hands of our native topographers. That is the system of broken horizontal hachuring, combined with the continuous contour when possible. It is not always possible to secure the necessary time or money for running out accurate continuous contours. The continuous contour system is no doubt the most scientific method of representing ground yet devised, but I should doubt extremely whether it has been possible to carry out all the continuous contours shown in the American maps with strict accuracy; and if they are not accurate they are misleading. I have had lately to deal with maps in South America which were mapped on that system by continental topographers. The mapping was, of course, not of the highest order. It was carried out very rapidly under the sort of conditions in which we generally run out our geographical maps in India, and it was an attempt to represent the country by a system of continuous contours. The result was in many cases most misleading. In some instances it was impossible to tell whether a single contour represented a hill or a depression. I may add that the system of adding shading to the hachures in order to intensify the relief of the hills has also been tried very extensively in India, and found to fail in the field for the reason that no two men have the same idea as to the amount of shading which should be applied in order to give effect to a given slope. We do not find that difficulty as regards the pen and ink drawing of the horizontal hachuring. Men trained in the same school produce maps that are fairly concordant in their results. The representation of a slope of a certain steepness in one man's map will be about the same in all the field maps. That is not so when they are allowed to make use of the brush. Then their artistic fancy comes into play, and all sorts of errors creep in. But on the whole, in the reproduction maps, I may say that I agree that the addition of shading is most distinctly effective, if it is not absolutely instructive. Major Close calls attention to the deficiency in the number of heights shown on the face of the map as regards the plains. This undoubtedly is a very great and very common fault, but the reason of it is that the heights which are given are chiefly those of hill-tops fixed in the course of triangulation. It merely emphasizes the necessity for the free use of the clinometer in the topographer's hands. The topographer is generally responsible for heights of roads and rivers, but I admit that these are often deficient in number. Now, as regards the specimen map, for which it has been proposed to apply a given sum, I do not quite know whether it is clear to every one here that it was only intended to carry the proposal out strictly within the limits of the Royal Geographical Society's premises. There was no idea of offering £100 for competition; it was merely to be voted for the purpose of producing, so far as we could, what might be accepted generally as a typical topographical map. It has been suggested we recommend that proposition for the consideration of the Council of the Royal Geographical Society.

The CHAIRMAN put the resolution to the meeting, and declared it carried.

Major CLOSE: My difficulty in replying to the criticisms is that I agree with most of them. Most of the discussion turned on the representation of hill features, and I think it would be a very good thing if we could have a bit of country mapped which would give us before our eyes the same ground shown in four or five ways. It is very difficult to compare a bit of country somewhere in the Sahara with another bit of country in the United States, and another in Sussex. And it is very difficult to get any idea of the value of the different methods of representing hills unless we deal with the same tract of country. I was interested in Mr. Philip's suggestion of a combination of shading, tint, and contours. It would be a very good thing to try. The representation of the same ground on different systems has a distinct educational advantage. It brings up the different ideas of absolute height, relative height, and steepness in a way that no single form of representation can do. It seems clear that we should devote more attention to topography now that the Society's days of exploration are gradually drawing to a close. And if we are to delineate the surface features of the Earth effectively, we should make up our minds as to the best way to do it.

The CHAIRMAN: I have only now to ask you to join in thanking Major Close for coming here this afternoon to give us such an interesting paper. We have had a most valuable discussion. The only difficulty about it is that it has been almost impossible to compress the amount of information which might be gained from an assembly such as this into the space of time which was at our command.

GLAREANUS: HIS GEOGRAPHY AND MAPS.

By EDWARD HEAWOOD, M.A.

CONSIDERABLE attention has been called within recent years to various manuscript maps by Henricus Glareanus, the well-known sixteenth-century philosopher and man of letters, which exist in the libraries of the universities of Munich and Bonn, and which have been described respectively by Professors Oberhummer and Elter (cf. *Journal*, vol. 10, p. 328). These maps were of interest mainly from the fact that, as avowed by Glareanus himself, they were based on the long-lost world-map of Waldseemüller, the recent discovery of which has attracted so much attention, and were thus for a time the chief helps available for the task of reconstructing the latter. It has not been generally known that a still more interesting series of manuscript maps by the same hand is in existence, together with the original manuscript of the treatise on geography, first published by Glareanus in 1527, and subsequently reprinted a number of times during the course of the sixteenth century. It may be, therefore, worth while to briefly describe the maps and manuscript, now in the possession of Major-General E. Renouard James, R.E., pointing out some of the ways in which they shed light on the part played by their author in the geographical revival of the early sixteenth century. A few preliminary remarks are, however, necessary.

Heinrich Loriti, better known by his adopted name of Glareanus

(from Glarus in Switzerland), has been described as one of the most accomplished men of his century.* He was one of the foremost of the band of "humanists" who endeavoured to instil new life into the dry bones of the scholasticism of the middle ages: and in the wide range of his studies were included mathematics, astronomy, history, philosophy, classical literature, and other subjects. He also acquired some fame as a poet, and at an early age obtained the nomination as "poet laureate" to the Emperor Maximilian of Austria. His geographical contributions, with which we are here concerned, formed, in fact, but a minor part of his many services to knowledge and culture. The small treatise above alluded to, in spite of the favour with which it was received, did not display any remarkable knowledge of the geography of the world from the standpoint of the third decade of the sixteenth century, and it has sometimes been cast as a reproach against its author that he shows such slight acquaintance with the most recent discoveries in the New World, while this seeming ignorance has been adduced as an instance of the slowness with which the new knowledge permeated the community in those days. The chief claim of the book to notice was held to be the fact that it, for the first time so far as we know, described a convenient method of constructing gores for a globe, which was much used during the period in question, various examples of gores prepared after this method having come down to us. In spite, however, of the definite statement of Myritius in his 'Opusculum Geographicum rarum,' published at Ingolstadt in 1590, that Glareanus was the inventor of this method, doubts have been expressed on the subject, owing to the fact that, though the 'De Geographia' of Glareanus was only printed in 1527, similar gores are in existence which seem to date from a good deal earlier. It is one of the chief points of interest in the manuscript recently brought to light, that it helps, in part at least, to remove both the difficulties here alluded to.

The history of the manuscript, which seems to have remained in private hands since it was first written, is in itself of considerable interest. At the time of the Elizabethan Exhibition, organized by the R.G.S. in 1903, an old volume was sent in as an exhibit by Major-General James, which consisted mainly of a collection of private correspondence of the sixteenth and early seventeenth centuries, relating in great part to the Reformation period in Switzerland. The volume was one of three (two of which are now lost) which came to the present owner by bequest from his great-uncle, the Rev. George Renouard (for many years a Fellow of our Society), whose mother (born 1732) was a member of the important Swiss family of Ott, settled at

* For a sketch of the life and writings of Glareanus, see O. F. Fritzsche, 'Glarean, sein Leben und seine Schriften' (with portrait). Frauenfeld: 1890.

Zürich as far back as the fourteenth century. It was, apparently, another member of the same family who originally collected the documents, which have never since passed out of the hands of his descendants. The first two items in the collection were treatises of some length, written in a clear and elegant Italian hand, but both unsigned and undated. The first bore no title, but a statement on the flyleaf by a later hand (presumably the collector of the documents), ascribing it to Glareanus, at once showed its interest to the geographer, which was heightened when, on turning over the pages, the beautifully executed series of maps was disclosed to view. Confirmation of the authorship was soon forthcoming on a comparison of the handwriting with that of the marginal notes on the Bonn maps, as well as from the general agreement in style shown by the two sets. The statement by the former owner was based on a comparison with other known writings of Glareanus, so that all doubt was set at rest by the mutual support of the two independent pieces of evidence. The text of the manuscript was next compared with that of the printed treatise of 1527, and the result was to show that, while to all intents and purposes the same work, the manuscript differed in many minor points from the printed volume; while the fact that many corrections and marginal additions made in the manuscript had been embodied in the printed work, showed that the former was the original draft of the treatise, and not a later copy. But as the work as printed contained in places additions of considerable length, the manuscript was not the actual copy from which the printer had worked, but must have been of earlier date.

All this, together with the great similarity of the maps (which, it should be observed, were not included in the printed work) with those known at Bonn, which date from 1510, suggested that the manuscript was considerably earlier in date than 1527, and it was seen that, if this could be established, a satisfactory explanation would be obtained, firstly, of the existence of gores drawn after the Glareanus method as early as 1515 or thereabouts, and, secondly, of the failure of the treatise to represent at all accurately the state of knowledge at the date of its publication. That works were in those days often laid by for many years before being printed is otherwise exemplified in the literary career of Glareanus. The second manuscript treatise contained in the volume (which has to do with Roman coins and measures *) is identical as regards paper and style of writing with the 'De Geographia,' which, as we know, was certainly written before 1527. Yet it was only in 1558, or over thirty years later, that the second treatise was eventually given to the public. Internal evidence, while tending to confirm the idea of an early date for the work, does not seem to yield a positive

* Its title is 'De asse et partibus ejus.'

proof. It may be shown with certainty that the manuscript was written after 1510, in this way. Writing to the Swiss reformer Zwingli in that year, Glareanus refers to the Rome edition of Ptolemy (no doubt that of 1490) as containing no modern maps. Therefore in 1510 he had not yet seen the edition of 1508, containing the well-known map by Ruysch, in which all the modern discoveries were laid down, whereas a copy of this very map is, as we shall see later, given in the manuscript treatise. A posterior limit is not so easy to fix, but the following points are of interest. The description of England, both in the manuscript and the printed work, is but brief, but a notable addition in the latter is an allusion to the "eruditus rex," Henry VIII. A reputation for learning had been gained by the king even before his accession in 1509, and must have reached the ears of Glareanus at quite an early date through his intimacy and frequent correspondence with Erasmus,* who, as is well known, resided in England for long periods during the first two decades of the century, making the personal acquaintance of the king while still Prince of Wales. Yet no mention is made of him in the manuscript. A second point is this. In the printed work (chap. xv.) we find a paragraph describing the author's intercourse with the learned Paris professor, Budæus, which we know to have been maintained during 1520. But this passage does not occur in the manuscript, which we may therefore suppose to have been written before 1520, at any rate. All things considered, it seems probable that its date is not much after 1510, the date of the Bonn maps.

This is of some interest as tending to enhance somewhat the originality of Glareanus' treatise on geography. Thus it was almost certainly written before the appearance, in 1524, of the well-known 'Cosmographia' of Apianus, to which it bears some resemblance, and on which it might be thought to have been to some extent based, if first written about 1527. It may be noted here that in the small 'Cosmographiæ Introductio,' first printed in 1529 at Ingolstadt, where Apianus was professor, and thought by some to be his work, the concluding paragraphs are taken bodily from the treatise of Glareanus, which had therefore become known in Bavaria within two years of its publication. This gives additional interest to the fact that in the gores brought to light by Baron Nordenskiöld (cf. 'Facsimile Atlas,' Pl. xxxvii.), which are among the earliest instances of gòres drawn after the Glareanus method, Ingolstadt is one of the two European towns marked, and was thus very probably the place where they were engraved. It may well be, therefore, that the draughtsman had become acquainted with Glareanus' method through the same channel

* A short letter from Erasmus to Glareanus, dated 1516, is included in the manuscript volume, but is in no way concerned with geography.

by which the printed work became known at Ingolstadt. In view of the predilection for map-drawing shown by Glareanus, it would be but natural to suppose that he had himself drawn a map of the world in the form of gores, on which some at least of the existing examples may have been based. On the other hand, if we accept the view that the gores in the Liechtenstein collection are those prepared by Waldseemüller in 1507 for the representation of the world "in solido," Glareanus cannot have greatly modified the method already in use, but merely supplied a convenient formula.* In any case, the method became generally known as having been originated by Glareanus, for it is so described, not only in the work of Myritius above alluded to, but also in the treatise added by Ruscelli to his version of Ptolemy, of which various editions appeared in Italy during the latter half of the sixteenth century.† There are one or two other points in regard to which the influence of Glareanus on his successors may possibly be traced, but to these we must return later.

The printed treatise of Glareanus, which was of small 4to form, consisted, with the title-page, of thirty-five leaves, and was divided into 40 chapters, starting from the elementary principles of geometry, the constitution of the universe and the methods of mathematical geography, and passing in the latter half to a brief description of the countries of the world. The arrangement of this part was almost entirely Ptolemaic, and only in the concluding chapter was reference made to America and other regions lately brought to light. It was illustrated by woodcut diagrams such as are found in most of the treatises on mathematical geography of the time. There were, however, no maps. The manuscript, which is of small folio size, contains, in addition to the diagrams (or most of them) which appeared in the printed work, the series of coloured maps to which allusion has been

* It may be noted that, on the Bonn polar map, Glareanus refers to the custom (followed by himself also), of placing the latitude notation in the interval between Zipangri and America. This would almost seem to show that he was acquainted with Waldseemüller's globe (or the gores prepared for it) as well as his plane-map; for the notation occurs in this position both in the Liechtenstein and the Boulenger gores, as also in the 1515 "Margarita" map, likewise ascribed to Waldseemüller. The reason would seem to be that the prototype of all, Waldseemüller's 1507 map, had started on the west from a similar line, along which the degree notation had therefore been marked. The fact that the longitude notation is marked along 50° S. might be thought to indicate that the maker or makers of the gores had previously had to do with maps ending at this latitude, as do those of Glareanus (the original 1507 map ceasing at 40° S.). A minor point of resemblance between the two sets of gores referred to and one of Glareanus' maps (the Munich hemisphere map) is the shifting of the southern extremity of South America from 320° to 330°, but this is probably accidental.

† In Rosaccio's reprint of Ruscelli's treatise (1598), Glareanus' name appears in this connection, by an obvious misprint, as "Galerano."

made above, together with an elaborate armillary sphere, and a diagram of the supposed concentric spheres of the universe. This last is of interest from the fact that in the centre of all is shown the town of Glarus, from which the author took the name by which he is generally known. The maps occupy seven pages, interspersed among the text, and are as follows. A map of the whole world, closely resembling the Bonn map, is, like the latter, a reduction from Waldseemüller's large map, while the hemispheres corresponding to the old and new worlds are shown in a pair of maps corresponding to the Alsatian geographer's insets. The next, occupying two opposite pages, is a reduction of the famous map by Ruysch, and though containing no original matter (for the legends, though given in the words of Glareanus, supply practically the same information as the Ruysch map), is of interest as showing that the Swiss savant was not content to take his information from one source only, but made himself acquainted with the best maps of the time. The last pair of maps are the most interesting, as forming (with the similar map at Bonn) the earliest examples of the employment of the equidistant polar projection that have come down to us. They are also the earliest instances of the division of the world into two circular hemispheres at all, the first printed map to do this being apparently that given in Ruscelli's Ptolemy in 1561. Whereas in the Bonn map the southern hemisphere was shown on a much smaller scale than the northern, and with the outlines reversed, in the present version the two exactly correspond. The adoption of this more or less obvious method of representing the globe does not necessarily imply an acquaintance with abstruse mathematical principles, but it at least shows its author as one who took an intelligent interest in the improvement of cartographic methods.

In regard to the projection of the other maps, there are one or two points to be noticed. While broadly conforming to that used by Waldseemüller for his great map of 1507, which was the second, or so-called "homeoter" projection of Ptolemy, Glareanus has introduced slight modifications of his own, which bear out the idea that it was in the technique of geographical science that he was particularly interested.* Thus the circles which represent the parallels of latitude are not concentric, as in other examples, but the centre is removed further and further from the equator as the north pole is approached. The intention would seem to be to avoid the great variation in the degree spaces intercepted on the meridians at different parts of the map, for we find that on the maps in question the lengths of the degrees of latitude are practically equal throughout, in spite of the obliquity

* The degree net has been somewhat more carefully drawn in the maps in General James's manuscript than in the maps previously known at Bonn and Munich, and may, perhaps, represent the final result of various experiments.

of the angle at which the meridians and parallels intersect at the edges of the maps. To bring about the said result, it has been necessary also to depart from the true proportion between the lengths of the degrees of longitudes in different latitudes, so that diminished distortion has been gained at the expense of equality of area. It would also be impossible to continue the map to the pole without concentrating the whole amount of distortion into the small area immediately surrounding the latter. North of 70° the degree net has, in fact, been constructed in a purely arbitrary fashion, with a view, apparently, of giving it a harmonious finish, by continuing the meridians in an even curve to the pole. Something similar has been done by Munster in one of the maps in his edition of Ptolemy, but the apparently close resemblance between this and Glareanus' maps is not borne out on further inspection, for the circles of latitude are concentric in Munster's map, and the diminution in the lengths of degrees of longitude is carried out in a different ratio. Still, from the intimate association of both geographers with the city of Basel, it is not impossible that the work of the one may have had some influence on the other.

It should be noted that, in the printed work, still another method of constructing the degree net is illustrated by a diagram, the parallels being in this case represented by straight lines, as in so many of the printed sixteenth-century maps, from Bordone (1528) to Ortelius; but whereas in these the parallels are drawn at equal intervals, in Glareanus' scheme they become rapidly closer as they approach the pole, their position being determined by a division into equal parts, not of the mean meridian, but of the circumference of the circle bounding a hemisphere. The method is again described by Moletus in his 'Discourse,' incorporated in Ruscelli's Ptolemy, and was used for one of the maps of the world to be found in Rosaccio's re-issue of the latter (1598), though in all other respects this was avowedly merely a copy of Rumold Mercator's map, while in Magini's Ptolemy of 1597 the latter's projection has been retained.

One other point is perhaps deserving of comment. This is the distinctive colouring of the continents, which is the same in all the maps now described, though the arrangement of the colours is somewhat different from that adopted in the Bonn maps. From a passage in Ruscelli's treatise above referred to, it appears that a convention was generally followed in his time with regard to the colours used for the different continents, which he assigns, curiously enough, almost exactly as they are employed by Glareanus, the only important difference being that, while Glareanus used green for America as well as Europe, in Ruscelli's time a lighter tint of the yellow with which Africa was coloured was chosen for America, red being used in each case for Asia. Ruscelli refers to the fashion set by those who began

to colour maps in this way ("perche cosi han cominciato a farle i dipintori"), and it would seem that here, too, the influence of Glareanus may be traceable, for, though his maps were never printed, his methods were no doubt widely known through his pupils.*

NOTE.—A reproduction, in colours, of Glareanus' North Polar map has been prepared at Chatham under the supervision of Major C. F. Close, R.E., and will appear, with accompanying letterpress, in the June number of the *R. E. Journal*.

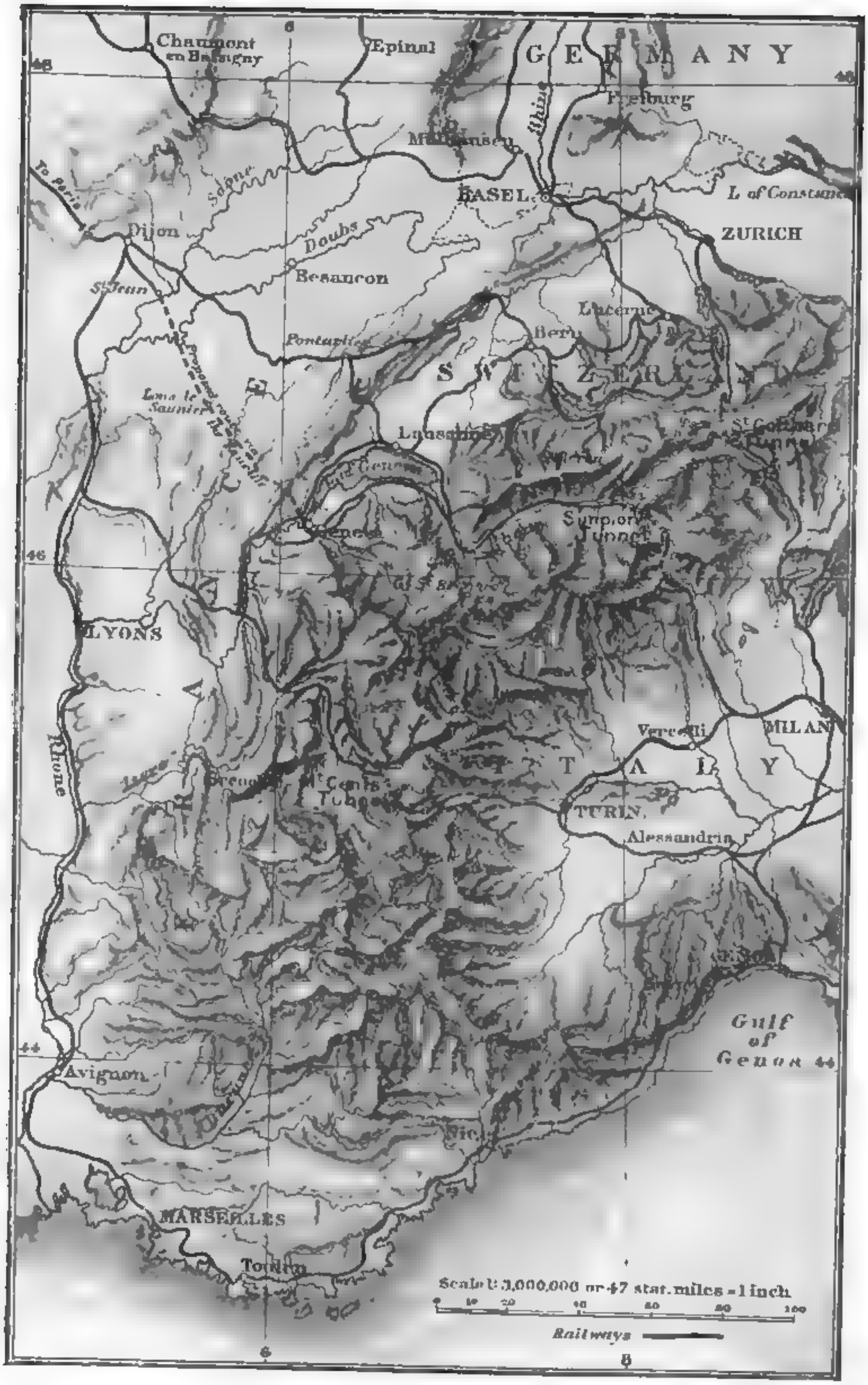
ALPINE RAILWAYS AND INTERNATIONAL COMMERCE.

By A. J. SARGENT.

IN spite of the recent development of the American continent, the Mediterranean and the East, thanks to the Suez canal, still seem to dominate, as in the Middle Ages, the economic ideas of Europe. Political schemes, and the unknown economic possibilities of the Far East, may, perhaps, be responsible for a somewhat exaggerated estimate of the value to Europe of Eastern commerce; but this estimate, whether destined to be justified or not, has a profound influence on present policy. The political rivalries of the Powers, here as elsewhere, are reflected in the economic arena. So the attack on the Alpine barrier, in one aspect at any rate, may be criticized as a phase in the struggle for the control of the East. The St. Gothard tunnel pierced directly, instead of outflanking, the ancient barrier between the plain of north-western Europe and the Mediterranean. The substitution of the artificial route for the natural outlet by way of the Rhône and Marseilles was undoubtedly a blow to those interests which France had built up in the course of centuries on the basis of her physical position. The chief line of communication, north and south, was removed suddenly beyond her frontiers, inflicting a twofold loss, as it affected international traffic or local relations with the Italian markets. The gain was to Germany and the Italian seaports. The St. Gothard scheme may be regarded as the economic complement of the movement which resulted in the Triple Alliance. It placed Germany in a commanding position in the chief Italian markets, and at the same time, by providing a short cut for fast traffic to the East, it added to the German sphere a new port in Genoa. France was side-tracked from the main line of continental traffic to the Mediterranean, though she still retains the bulk of the fast traffic from London, the chief terminus of the Far Eastern route.

Hence it is no matter for surprise that, a generation ago, proposals were made in the French Chamber for a new tunnel through the Simplon,

* In some of the early printed editions of Ptolemy in which the maps have been coloured, we find red used for Europe, and yellow for Africa, while Asia is left white.



MAP TO ILLUSTRATE RAILWAY COMMUNICATIONS THROUGH THE ALPS.

2 x 2

to be financed by France. The project came to nothing; but now that it has been executed under other auspices, France is faced with the problem of its best utilization. Can it be so used as to compensate for some of the losses due to the St. Gothard, or is it destined to reinforce them by abstracting still more of the existing transit and other traffic from the French area? Geneva will have easy access to Italy, while Berne, isolated between the existing routes, has a project in hand for the piercing of the Bernese Alps, which would give *viâ* the Simplon an alternative through route from Italy to the Rhine valley and the Low Countries. The problem is mainly physical. The Jura plateau, less impressive on the map than the masses of the Alps, is an obstacle hardly less formidable to the railway engineer. It is sufficiently high to involve severe gradients and risk of snow-blocks for any line surmounting it, while its great breadth would require tunnels comparable in length to those under the Alps. The present route from Dijon by way of Pontarlier to Lausanne is unfitted for fast and heavy traffic; it must be improved greatly or an alternative discovered. In any case, the scheme would be costly, and various projects have their enthusiastic supporters in France. It is a matter for the engineer and the geologist. But, whatever be the ultimate plan adopted, the work must be done, and done quickly, if France is to obtain any advantage by the transference of her objective from Turin to Milan. The advantage would be considerable; it may be estimated, perhaps, at two hours in time between Paris and Milan. France would thus secure better access to the chief Italian markets, and at the same time establish more firmly her claim to the Indian mail route from London. But the gain of Paris and the Loire region would probably represent a further loss to the Rhône valley and Marseilles, and it is hard to see how this could be avoided. Prosperity which depends largely on position is somewhat unstable under modern conditions of transport, as various districts in England have good reason to know. This is a characteristic result of improved communications all the world over. The Italian route itself is threatened by the eastern extension of the German system. Salonika and the Piræus may one day become formidable rivals to Brindisi and Trieste, while they in turn, perhaps, may be affected adversely by the Euphrates valley line. It is possible, however, to over-estimate the value of such schemes for international traffic. There is no need yet for the shipowner to tremble greatly for his business. For general traffic the rail is but a poor substitute for the sea. Neither the Siberian nor any other railway is destined to destroy the value of the Suez. The experience of Manchester in the matter of railway rates, an experience largely responsible for the opening of the Ship Canal, is sufficient proof. Freights at 7*s.* per ton from Manchester to Liverpool by rail, and 14*s.* per ton from Liverpool to Bombay, convey their own lesson without need of comment.

By a curious irony of events, at the other end of the chain of far-eastern communications, France has been promoting a scheme which might provide for others the experience which she herself has suffered. The development of railways in the Red river basin is in part directed to the side-tracking of Canton and even Shanghai from the route to the unknown wealth of the Yunnan region. The Burma railway scheme is a similar project of still more drastic character. The relative cost of the rival lines is a mere question of engineering; but the extent to which they could compete with transport by road, river, and sea is far from easy to estimate. The advantage of the rail lies in the shortening of time and the possibility of avoiding transhipment; but there it ends. Even if the whole trade of the terminal region could be thus diverted, it is doubtful whether it could support a great trunk line. The move is a move in the dark. The prophets have experienced so many disappointments in the Chinese area, that there is good ground for caution, if not for pessimism, in dealing with any large project.

The railway projector is much to the fore at present, with plans for connecting and developing the newer regions of the world. The investor might be grateful sometimes for more definite estimates of the expected commercial profits. These are sometimes left to the imagination, and imagination is hardly a safe guide in such matters. Each continent has its own special schemes for great trunk routes, though in no two cases are the conditions the same. The bridge over the Zambezi is acclaimed as another link forged in the great African chain from the Cape to Cairo. A scheme so vast inevitably appeals to the imagination: but can it justify itself economically? Suppose the difficulties, financial and political, overcome, and the great trunk road completed; it is natural to ask, What definite object will it serve? The experience of South Africa may provide some illumination. If this region is to have any permanent value for the white races, it seems likely that the economic centre of gravity will be far removed from the Cape. The natural means of access to this centre will not be by a long and costly route from the extreme south, but by a short cut from the nearest port on the east or west coast. The transference of traffic has already been effected on a considerable scale, and is destined to continue. A freight-rate from Port Elizabeth to Johannesburg of £7 per ton as against 30*s*. for the same goods from Europe to South Africa, is sufficient proof of the need of shorter railway routes. At the other end of the chain, Lower Egypt is to be avoided by a direct line from the Nile to the Red sea. In fact, the two ends of the Cape to Cairo line are fast losing their character as integral parts of a through route. The African areas naturally seek the shortest way to the sea and to Europe; the Uganda line is a case in point. The great trunk lines of the world inevitably suffer from their permanence, as opposed to the flexibility of ocean trade routes. When, as in Canada, there is

a growing community at either end and an absence of alternative means of transport, when, too, there are evident possibilities of development in the intermediate regions, there may be a reasonable prospect of economic success. But few existing lines are in this happy position. If it still pays to send goods round the Horn from New York to San Francisco, what will be the position of the railways of the United States when easy communication by sea is established, *viâ* the Isthmus, between the industrial eastern States and the west coast of the Americas and the Far East? They may lose as the Suez will lose; the advantage will be to American industries. Indirectly, too, the West Indian islands, hitherto outside the main tracks of the world's commerce, may hope to gain somewhat in economic as well as political importance from their position on what will be the second great sea-route of the world. The problem is the same everywhere. On some of the American railways the utmost possible economy, and therefore the lowest possible cost in the carriage of goods under present conditions, has been reached; the great ocean lines, on the other hand, have established normal rates to various regions, which are probably somewhat above the level at which they could afford to work and still make a profit. Here is a basis for comparisons at the present moment. But the steamers are not tied to a costly permanent way, and can take immediate advantage of any shortening of routes; nor have they yet reached the limits of speed and carrying capacity: yet speed for passengers and mails, and the absence of transhipment for goods, are the chief weapons of the rail in its fight with the sea. The railway projector and the investor, in promoting schemes for a distant future, do not always make due allowance for the element of flexibility.

THE ALEXANDER-GOSLING EXPEDITION.*

We have received a further budget of news from Lieut. Boyd Alexander, bringing down the record of progress to February 2 last, at which date the leader was at Maifone, whither he had returned to visit his brother's grave before finally starting from Lake Chad in the direction of the upper Nile. As already mentioned, it was his intention, if possible, to cross the lake by boat, sending the main caravan round by road, under Captain Gosling, to Kussuri, which was to be the next base of the expedition. The greater part of the letter is devoted to a description of the route followed last year between Loko on the lower Benue and Yo on the west side of Chad, and as this traversed, in part, districts not yet visited by white men, Lieut. Alexander has been able to collect some interesting information, both on the country and the people, especially the distribution of the native tribes, the number of which is, he says, truly remarkable.

The scenery, which was at first uninteresting, showed signs of improvement on leaving Nassarawa, the flat bush-covered country, with its tropical river-belts,

* See *Journal*, vol. 24, p. 589; vol. 25, pp. 176, 456.

being studded in places with groups of conical rocky hills clothed with tree-growth, while the hill country north of Keffi showed out in the blue distance. Nassarawa did not particularly impress the traveller, the wealth of the Fulani having much diminished with the recent reduction of slave-trading activity. The street corners are now remarkable for their beggars. Keffi, another large town of round and square mud-built houses, surrounded by a massive wall over 2 miles in circumference, is in great part in ruins, the result of the reprisals taken by the British authorities after the murder of Captain Moloney. It is now a British station with a Resident and Police Officer.

Lieut. Alexander does not appear to have been favourably impressed with the Fulani, the spread of whose influence throughout Nigeria is not, he says, so remarkable as it might seem, only the tractable plain-dwellers having been subjected to it, while the Pagan hill tribes have been left severely alone. Intermarriage has caused an almost total disappearance of the original Fulani stock, though an indication of what this must have been like is afforded by the "Bush Fulani," a small and dwindling community, who live entirely in the bush, driving their flocks from one district to another. Retiring and shy in disposition, they seldom approach the towns, but carry on necessary traffic in bush markets held on certain days. The women are handsome, tall, and pale-skinned, with oval faces surrounded by thick twists of silky hair. It is the general opinion and hope amongst the Fulani that the rule of the white man will not be for long, and this idea is fostered by the Senussi, who are very active just now, especially about Kuka.

Beyond Keffi the main road was left, a north-easterly direction being taken for the Fulani town of Dorroro, situated at the foot of a lofty hill range, the stronghold of the fierce Kagoro tribe. These people are head-hunters of the worst type, and, as among the Dayaks, a man must produce so many heads before he can aspire to a wife. Lieut. Alexander made his way to a village of the Kagoro, named Petti, built on the sides of a high rocky hill, the small mud houses being cemented to projecting rocks, and to be reached only by the narrowest and steepest of paths. The people, who were seen from a distance squatting like monkeys on the rocks, are strongly built, but their feature are disagreeable, and show a marked resemblance to those of the tribes south of the Benue. They are keen hunters, fight with poisoned arrows, and use small hill ponies, by means of which they quickly communicate from one hill-top to another. The hills inhabited by them extend to within a few miles of Badiko. Not far from the latter are the tin-mines of Tildi, but, owing to the dangerous nature of the country, little has yet been done to exploit them properly. West of the Kagoro country are the Kachia and Panda hills, about 800 feet high, forming the watershed between the Gurara and Kaduna rivers. They are inhabited by the Kachias, if anything still lower in type than the Kagoro. Among the men a leaf forms the only covering, but the women wear behind a curious cylinder-shaped ornament, 8 inches long and 3 in diameter, which at a distance gives one the impression of a tail that has been docked. They also insert discs of wood in both lips, which cause a revolting disfigurement.

The journey was made in the height of the rains, and, being through a well-watered region, the fording of streams was continuous, while in several places bridges had to be made. The Gurara was in full flood, and was running at the rate of 15 miles an hour, so that its crossing (by native rafts) took nearly a whole day. On September 8 Bauchi was reached. The emir, whose palace consists of a series of lofty flat-topped structures of mud, with walls 6 feet thick, still keeps up a show of state, and strangers are received with many formalities. The rooms of the palace have groined roofs of clay, which, being blackened by age, have all the appearance of old oak. The emir sees as little as possible of Europeans, and

Lieut. Alexander was not much impressed by his friendliness. At Bauchi the little-known route to the Gongola through Goram, Kufa, and Ako was taken, instead of the main road through Gombe, and the leader was able to prove the accuracy of the mapping previously done by members of the expedition. The towns hereabouts are Fulani, with a mixture of Hausas. The walls are in many places ruinous, as their repair would be understood as implying the wish of the chiefs to fight again, and cannot therefore be allowed. At Maimadi an exhibition of Hausa wrestling was for the first time witnessed, and the performance is described as a most striking one. Wrestling is adopted as a means of settling disputes, and is carried on in a most orderly way in the presence of umpires, all the inhabitants turning out as spectators, while the performers observe the rules of the game in every detail. The wrestling resembles that of the Greeks and Romans, and as the Hausas alone practise it, Lieut. Alexander suggests that they may have brought it with them from an earlier home in North Africa, and that light may be thrown in this way on their past history. A route from Egypt along the shores of the Mediterranean to Tripoli, and thence across the desert, would be the most likely to have been followed, as being the best calculated to develop the trade to which the Hausas are so devoted. The use by these people of the term *Rakumi daji* ("camel of the bush") for the giraffe is also pointed out as an indication that they came from a land where they had been familiar with the camel before learning to know the giraffe.

On October 8 the caravan crossed the Gongola at Ashaka, and in three days reached Gujiba, traversing a country well wooded in places with acacia. Gaidam, on the Komadugu, was next reached. With its sandy stretches and square mud-built houses, it had the appearance of an Egyptian town. The road hence to Yo gave occasional glimpses of the Komadugu—a pretty river with a very winding course, its southern bank thickly wooded with acacia, which here and there gave place to bright green patches of young wheat (*alkama* in Hausa), which is grown in some quantities by the help of irrigation. The adoption of a hard-and-fast line like the Komadugu as the Anglo-French boundary is thought by Lieut. Alexander to have its drawbacks, as deserters, when once across it, cannot be touched by their former chiefs. This would, however, be incidental to any new boundary in a region only partially under control. The towns on the south bank along the lower course of the river are inhabited by the Mobbur, described as closely resembling the Berbers. The women are small, with round faces and somewhat *retroussé* noses, which are ornamented with coral in the Kanuri fashion. The hair falls at the sides and back in a straight fringe of thick twists. The dreaded Tubu come very close in appearance to the Mobbur. They give much trouble, raiding and robbing the caravans on the south side of the river and retreating to the other side with the spoil. By the end of December the river has fallen so much as to be fordable in many places, and at this time the Tubu reap a golden harvest. They travel in small bands, covering long distances on their camels and small fast ponies, concentrating when a raid is in contemplation. Not long before, the great Mecca caravan had been attacked by a combined force of Tubu and Mobbur (the latter of whom use poisoned arrows) on the way from Gaidam to Yo. Thanks to the bravery of the Kachella of the latter place, the freebooters were kept at bay until the caravan reached Bulturi, but it was closely besieged there until Lieut. Alexander came to the rescue with a force of archers. The caravan, which had originally left Timbuktu more than two years before, had at the time swelled to the number of 700, who formed a picturesque and motley crew, each band of pilgrims driving its own particular herd of cattle (the total reaching nearly 1000), and carrying all its worldly belongings. The sight was most impressive, and

seemed more properly to belong to a bygone age. Besides Fulani, there were in the caravan (which included whole families down to the smallest infant) many pilgrims from Melli, north of Sokoto. The Melli women are tall and handsome, dark-skinned, but with Arab features. They wear massive silver earrings, and their hair is done in the Fulani fashion—dressed in the shape of an inverted canoe along the top of the head. These caravans pass through Bornu every four years, and the "Mallums" in charge expected to reach Mecca in four years from the date of reaching that country.

In Bornu, besides the Kanuri and the Arabic-speaking Shuas, the Kanembu (from Kanem) are met with about Kuka and to the south-east. The men are remarkable for their height, but dress like the Kanuri in the dark-blue "tobe" reaching to the knees. The women disfigure themselves by inserting a stick of coral in the left nostril. They pay much attention to their coiffure, the hair on the crown being beautifully plaited, and the ends brought down in a thick fringe all round. In Central Bornu, the grain-fields, which require but little cultivation, extend in places as far as the eye can reach. Like former travellers, Lieut. Alexander speaks of the laziness and vulgar swagger of the Kanuri, who, however, worked better under Rabeh and his son Faterella than they do now. The son, as well as the father, is said to have been a capable ruler. A large part of northern Bornu is practically useless, scarcity of water being the burden everywhere. At the time of writing, the harmattan was blowing, and the weather, especially near the lake, was very cold, the thermometer falling to 43° in the early mornings. When the wind is strong, the whole country is enveloped in a chilly sand-laden atmosphere, the resemblance to a foggy day in England after a hoar-frost being enhanced by the coating of sand which covers the branches of the acacia trees. As already mentioned, the objective of the expedition is now Mahagi, on Lake Albert, whither the leader hopes to take the boats, making use of the river systems *en route.*

REVIEWS.

AFRICA.

Tunis.

'La Tunisie au début du XX^me Siècle.' By various authors. *Illustrated.* viii., 368. 8°. Paris: de Rudeval. 1904.

This is the second volume to appear in a series which was inaugurated with a similar work on Madagascar, and is designed to promote interest in French colonial expansion. The chapters are lectures originally delivered in Paris in 1902, under the auspices of the Société de l'Enseignement Colonial Libre. Prof. Blanchard, of the Faculty of Medicine in Paris, has acted as editor, and Prof. Marcel Dubois contributes a geographical introduction. There are eleven other collaborators, all specialists in some science, and the result of their joint labours is an authoritative, although necessarily very rapid and popular exposition of the present state of knowledge in regard to the geology, botany, zoology, archæology, anthropology, and actual social state of Tunisia. About a third of the volume is taken up with antiquities and politics. The latter section and that on native society are naturally a good deal coloured by colonial propagandism. All is for the best in that best of all possible worlds, a French colony; magnificent vistas of progress open to infinity; the people and their protectors are welded together by a union of hearts; and so forth. But on the whole the account is characterized by sanity, and we note one reasonable

and luminous suggestion in regard to western Islam—that the tendency of North African Moslems to form themselves into confraternities is not due to any instinct for conspiracy, as many alarmists have taught, but to native inability to find complete satisfaction in the pure Arab cult, which admits no intermediary between man and God. The confraternities practically introduce the priestly element, so sternly excluded by the Prophet. Prof. Dubois' lecture is mainly concerned with climate, and he discusses the difficult question of climatic change in historical times. The geological chapter suffers by the indifferent reproduction of its illustrations; it deals with what may be called applied geology, *i.e.* the utilitarian aspect of the science, mineral deposits, water-bearing strata, and so forth. It is to be regretted that its author, M. Pervinquière, has not touched on the interesting problem of the coastal sinking in North Africa. The botanical chapters are two, the first dealing with native vegetation, the second with cultures and acclimatization. Bibliographies for fuller reference are appended to the different chapters, but they are evidently meant for French rather than international readers.

South Africa.

'History of South Africa.' By George McCall Theal. *Numerous charts.* 3 vols. Swan Sonnenschein. 1903–4.

For over forty years Dr. Theal, late keeper of the archives of Cape Colony, now colonial historiographer, has been engaged in preparing and publishing various works on the geography and history of Africa south of the Zambezi. Of these the most comprehensive have been a 'Compendium of the History and Geography of South Africa,' three editions of which appeared between the years 1874 and 1877, and a 'History of South Africa,' covering the period from 1486 to 1872, issued in four *unnumbered* volumes in 1888–91. The three volumes here under notice are also unnumbered, and as, moreover, they begin and end most abruptly, with no clear indication, either on the title-pages or in the preface, as to their relation to other publications, it should be explained that they form a section only of a series which is doubtless intended to be final, and to supersede all previous works dealing with South African matters. Above chapter i. of each volume occurs the heading "History of South Africa since the British Conquest," while on the several title-pages are given the periods 1795 to 1828, 1828 to 1846, 1846 to 1860, which are covered by the respective volumes, and are treated with great detail in the light of numerous fresh data drawn from official and other generally trustworthy sources.

Here, therefore, we have presumably Dr. Theal's last word on the many obscure or entangled questions which kept home and colonial feeling at boiling heat for over six decades, and some of which still await satisfactory solution. It will, I think, be conceded that, with perhaps one notable exception, the author's claim "to write without fear, favour, or prejudice, to do equal justice to all with whom I had to deal," is fully sustained. A due regard for rival interests, an unbiassed and judicious, one might almost say judicial, tone, pervades these authoritative volumes, which are, moreover, written in a lucid if somewhat pedestrian style. Assent will readily be accorded to Dr. Theal's conclusions on the emancipation and its consequences; on the rights and wrongs of the burghers before and after the Great Trek; on the Natal, Orange River, and Transvaal settlements; and especially on those deplorable Kafir wars which followed each other, so to say, automatically over a great part of the nineteenth century, all inevitably provided for by the pernicious Glenelg policy, itself the expression of the sham philanthropy at the time rampant in England, and still far from extinct. This whole section will serve as an excellent object lesson on the fatuous teachings of the Reads, the Philips, and some other

missionaries, who went about proclaiming the absolute equality of all races, and telling the blacks that they "were in all respects, except education, mentally equal to the European colonists."

The above-mentioned possible exception to Dr. Theal's uniform impartiality has reference to his treatment of the Kolobeng episode, in which he tells us that he followed Livingstone's account in all the editions of his history issued before 1878, but in the light of fresh evidence has since adopted what must be distinctly called the Boer version. But to the ordinary reader he will appear to have done much more than this, since a comparison of the early and later editions plainly shows that his whole attitude towards the Transvaal Voortrekkers has, without any apparent reason, undergone a complete change. Whether Livingstone's books and papers were scattered over the veld by the Boer commando, or by a band of hitherto unidentified "lawless deserters," is of course an important, though after all a secondary matter. The real points were the general treatment of the natives by the Boers, the kidnapping of their children to be brought up as "apprentices," that is slaves, and the persistent efforts of the burghers to block the "English road" to the interior of the continent. Of all this we now hear little or nothing. The English road now becomes merely the "lower road;" the Maccabe incident is suppressed, and it is merely stated that the children captured at Kolobeng "were apprenticed to various persons." But we are no longer told, as in the early editions (ii., p. 162), about the sad fate of these "wretched orphans" [both parents being killed], and that "hardly any condition could be more pitiable than that of these unfortunates." It must be added that most of the fresh evidence appealed to in explanation of this apparent *volte face* comes from tainted Boer sources, such as that of a Commandant Scholtz, who is himself deeply implicated, both for causing Livingstone's workshop to be broken open in his absence and confiscating "the whole of the loose property in the place," and also for retaining as "apprentices" the children of the Bakwena people captured on this occasion.

All of these boldly printed volumes are supplied with carefully prepared synoptical indexes, and with sketch-maps or "charts," which will be found useful in following the text and studying the gradual expansion of the white settlements south of the Zambezi.

A. H. KEANE.

THE HYDROGRAPHY OF THE NILE.

'The Nile in 1904.' By Sir W. Willcocks, K.C.M.G. London: 1904.

Though books dealing with the basin of the Nile are numerous, those which treat specially of the hydrography of the river are few, and the present volume is intended by the author to bring up to date Lombardini's essay on the hydrography of the Nile, which was published forty years ago; * but the fifty-five pages which have been allotted to hydrography are insufficient to represent adequately the hundred and ten pages of Lombardini's essay, as well as the information which has accumulated since then.

The course of the Nile is briefly described, and the slopes and velocities of the different reaches are detailed, but the altitudes used are not always those which are usually taken as the most probable values. Lado is taken as 447 metres instead of 465, but no reason is given for preferring the lower value.

The rainfall of the basin is very superficially dealt with, considering its importance and the large increase of data in the last ten years. Several errors are due to this, and the basin of the Blue Nile in Abyssinia is credited with a good

* 'Essai sur l'Hydrologie du Nil.' Milan, 1865.

rainfall throughout nine months of the year, which is probably based on that of Adis Abeba on the eastern escarpment; but all over the tableland there is a sharply defined period of four months, only extending to five in the more southern parts.

The geology of the lake plateau is of great importance in determining the drainage, since Dantz and others have shown that the movements of large blocks of the country have given rise to valleys with a low slope, in which the rivers lose themselves in the marshes which fill the valley floors. Indeed, without a knowledge of the structure of the country the drainage cannot be properly understood. Still, the account given is meagre, and does not include recent results, Ruwenzori being still described as a range of lofty volcanoes, in spite of its vulcanicity having been repeatedly disproved.

Passing to the more detailed description of the different lakes and rivers which supply the Nile, the statement that the rate of evaporation on the Albert lake is greater than on Lake Victoria is surprising, since the former lies 450 metres lower, and is much more sheltered from winds, so that a lower rate would be expected. There are, however, no observations available. The regulating action of this lake is said to be such that the floods of the Victoria Nile are delayed five months in their passage down the Bahr el Jebel; but this seems to be an assumption based on the maximum level of the lake being reached in December, while the Victoria lake is usually highest in June. The effect of the rainfall of this region has, however, been misunderstood. The discharge of the Victoria Nile after passing through Lake Choga becomes practically a constant amount, and it is the rainfall on the hills north of Foweira which causes the flood in the lower reaches near the Murchison falls. This rainfall begins about June and ends in October, while at the south end of the Albert lake it is heaviest in May and November, so that the combined effect is to produce a rise in the Albert lake, and at Wadelai from May to December. In discussing the Bahr el Jebel, or the Albert Nile, as Sir W. Willcocks would prefer to call it, he states that the sadd * region is flooded by the Sobat flood to a depth of 3 metres, which would, indeed, give a vast quantity of water temporarily stored. But if the water-slope between Lake No and the Sobat is considered, it will be found that a rise of about 2 metres in the Sobat will produce the flood slope in the White Nile above it; and in 1903 the Sobat rose in all 3·5 metres, causing thus a rise in the water-level at Lake No of about 1·5 metre, or about 1 metre above its banks, which agrees well with observations made by a survey party in September. If now the slope of the Bahr el Jebel be considered, it will be seen that the flooding due to the Sobat must soon disappear upstream, though its effect will be more pronounced in the Bahr el Ghazal, where the slope is less, and it is probably the main factor in producing there the late maximum in December which Dyé noticed. Sir W. Garstin's sections of the Bahr el Jebel, some of which are reproduced in this book, do not show any such inundation effect. Sir W. Willcocks follows Lombardini in assuming that the swamps of the Bahr el Jebel and Bahr el Ghazal occupy the site of an ancient lake, an hypothesis which presents many difficulties, and would hardly have been put forward by this distinguished engineer had he ever visited the region south of Khartum. In the present work this lake is described as occupying an area of 160,000 square kilometres, or two and a half times the size of Lake Victoria, and as being fed by the waters of the Sobat, the Bahr el Jebel, and the Bahr el Ghazal, while the Blue Nile

* It is very desirable that the word "sadd" should be limited to its proper meaning —a block of vegetation in a water-channel. It has of late been also used to designate a district and a class of vegetation.

also is made to "flow backwards up the bed of the present White Nile" into this lake. No evidence is put forward for such a reversal of the drainage of the country, and there is much which contradicts it. Unless subsequent earth-movements are assumed, the lake must have risen to the same level north of Lake No as south of it, which would considerably increase the size. No signs of shore-lines, terraces, or the deltas of tributary streams are to be seen where the margin of this lake would have been. On the drainage being reversed, the present White Nile should have cut through thick deposits which had been laid down by the Blue Nile when it entered the lake, but no such alluvial beds exist.

The country near Khartum shows no sign of the movements which must have taken place to turn the Blue Nile from flowing southwards, as assumed, into its present course. On the other hand, a stream flowing with a low slope in a shallow valley which is more or less flooded in the rainy season, furnishes all the necessary conditions for the formation of these marshes without creating a former lake to explain them.

At Khartum the holding up of the lesser stream by the greater again occurs, but with much greater effect than at Lake No, on account of the volume of the Blue Nile in flood. The author, however, exaggerates this very greatly when he says that the water of the Blue Nile flows 300 kilometres up the White Nile in summer. As the level of the Blue Nile increases, the level of the White Nile is raised by water coming down from above, and not by the Blue Nile flowing up it. There are many proofs of this, both from observations made at Dueim, near Khartum, as well as from the water-slope given in this work, and also in Table XXIV.; for if the Blue Nile flowed 300 kilometres up the White Nile, the mean annual discharge of the White Nile at Khartum would be greater, and not less, than at Taufikia, since at the former place both the Taufikia water and that which had flowed from the Blue Nile must eventually pass down.

The sketch of the development of irrigation in the earliest times will hardly be accepted as it stands by students of Egyptology. The Nile is described as widening and deepening its trough since the twelfth dynasty, but all available evidence goes to prove that it has been raising its bed at the rate of about 10 centimetres per century from at least as early a period as this.

Much of the chapter on projects for the utilization of water has previously appeared in other works by the author, and in discussing Sir W. Garstin's recent proposals, he would prefer the improvement of the Bahr el Jebel to cutting a new channel from Bor to the Sobat.

It cannot be said that this work furnishes a full account of the hydrography of the Nile, nor are all the statements made in it free from doubt; but it is much to be regretted that in such cases more proof is not given, and that no references or authorities are quoted. This alone will prevent it from becoming the work of reference for the Nile and its *regimen*, which Lombardini's essay was for years.

H. G. LYONS.

AMERICA.

A FEATURE OF THE BRAZILIAN COASTS.

'The Stone Reefs of Brazil: their Geological and Geographical Relations, with a Chapter on the Coral Reefs.' By John Caspar Branner. (Bulletin of the Museum of Comparative Zoology at Harvard College. Vol. xliv. Geological Series, No. vii.) Cambridge, Mass., U.S.A. 1904.

Prof. Branner, in the course of his geological travels in Brazil, has devoted much attention to the "stone reefs" which fringe the coast. They are remarkable features, which can be paralleled only in the Levant and on the shores of the Red

sea. Usually not more than a few yards in width, and rising often only a foot or two above mean tide-level, they run often for several miles from headland to headland or across the bays. They consist of quartzose sand cemented by carbonate of lime, and have many points in common with the sand-spits and off-shore beaches seen on many exposed coasts. The best known is that which guards the harbour of Pernambuco, but excellent figures and charts of nearly all the best instances are given in this volume.

Coral reefs, also, are known in these seas, but have no close connection with the "stone reefs." Many problems arise regarding their origin and the manner in which their materials have been cemented together so that they can resist the direct attacks of the Atlantic surf. The author points out that the cementing action is confined to those regions where sea-water has nearly its maximum concentration. He believes that river waters, rich in dissolved lime-salts, percolating outwards through the porous sand-reefs, deposit carbonate of lime where they come in contact with the highly saline ocean-water. Prof. Branner's monograph is distinguished for the fulness of detail with which the subject is treated, and the caution with which inferences are made. Incidentally, it contains much interesting information regarding the Tertiary and recent deposits of the Brazilian coast and the changes of level there since Pliocene time.

J. S. F.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

An English Suess.

'The Face of the Earth.' By Edward Suess. Translated by Hertha B. C. Sollas, under the direction of Prof. W. J. Sollas, F.R.S. Vol. 1. Pp. xii., 604. The Clarendon Press. 1904.

Twenty years have now elapsed since the appearance of the first volume of Prof. Suess's 'Antlitz der Erde,' and the publication of an English translation within the last few months is at least a tribute to the originality of the author's conceptions and to the place which the book holds in geological literature. Most treatises on general scientific subjects are relegated to a back shelf long before they have reached this age. Although the delay in bringing out the book in an English version might seem to imply otherwise, it has always been warmly appreciated in Britain, and its author has been the recipient of many of the highest honours which English science can award him. Scattered through the literature of British geology and geography, innumerable references to the 'Antlitz der Erde' will be found, which show how deeply it has made its mark on current speculation regarding all the greater problems of dynamical geology and geographical evolution. At the universities Prof. Suess's work has always been much studied, and the British student is now to be congratulated on having so eminently satisfactory a translation at his hand. Apart altogether from the inherent difficulties of the subject, and the prodigious learning exhibited on every page, the book was by no means easy to read in the original, on account of the graphic and idiomatic German in which it was written. Few foreign writers in geological subjects have the profound and extensive knowledge of the literature of the geology of Britain and British possessions which Prof. Suess commands, and hence, in its new form, the book will certainly appeal to many geographers, travellers, and general readers who might not otherwise have been able to familiarize themselves with it.

The translation is a very successful one; clear, terse, and graphic, it has many of the literary merits of the original, and the occasional bursts of eloquence in which the author indulges have been rendered with considerable skill. The version

follows the original German edition, and while the orthography of some of the geographical names has been modified in accordance with English usage, a few of the woodcuts retain the German titles. In the French edition many additional illustrations were introduced, together with supplementary references to original sources of information; these make this version on the whole the most useful for geologists, but the task of adequately illustrating the 'Antlitz der Erde' is nearly a hopeless one. In some of the chapters the reader wanders through a maze of geographical names, and to follow all the descriptions in detail would involve the consultation of a library of atlases and papers. Then in a brief and vivid summary the results of the inquiry are brought to a focus, and the great principles involved stand forward in the clearest light.

In this volume we have a synthetic study of the mountains of the globe. The work begins with a general introduction in which the main lines of geological evidence are sketched—earthquakes, volcanoes, changes of level, faulting, and erosion; this includes a brilliant chapter on the Noachian deluge, which, it is argued, finds a rational explanation in a fortuitous conjunction of seismic and cyclonic disturbances over the plains of the lower Euphrates. The second part opens with a discussion of the Alps and the relation between the great system of Alpine folds and the stable platform of older rocks which lies to the north of them. This mountain system is then traced through the great hook-shaped curve of the Apennines into North Africa, and across the pillars of Hercules into the Betic Cordillera, while to the eastward it sweeps through the great semicircle of the Carpathians. The great sunken areas of the Adriatic and the Western Mediterranean are shown to lie within the mountain arcs, and the Tertiary history of the Mediterranean area is outlined in a brief but highly significant chapter. From Europe we proceed to Asia, and examine the great mountains which diverge from the upper valley of the Indus. The whole vast system of Tertiary folds is contrasted with the stable areas which lie to the north in Europe, Siberia, and China, and to the south in Central Africa and the Indian peninsula. Lastly, in two chapters, the mountains of the western hemisphere are briefly discussed.

Over this wide field the author ranges with consummate ease; his knowledge of the geological literature of the most distant countries is equalled by the skill with which he seizes on those facts which are of prime importance. It is his aim to show the harmony which underlies phenomena apparently discordant, and to point out the analogies in structure and history in the different mountain ranges of the world. Criticism may easily be directed on individual points, but the wide scope and philosophic depth of the main argument must impress every reader. No book has ever proved more stimulating in the best sense than the 'Face of the Earth,' and we return to it again and again with renewed enjoyment. It is to be hoped that the second volume will appear in English without great delay; the third volume has not yet been completed in the original edition.

J. S. F.

GENERAL.

The Position of Geography in Science and Education.

'Die Erdkunde: eine Darstellung ihrer Wissensgebiete, ihrer Hilfswissenschaften und der Methode ihres Unterrichtes.' Herausgegeben von Maximilian Klar. Leipzig und Wien: 1903-1905.

The necessity of placing the teaching of geography in intermediate education on a higher level than it stands now, is being very keenly felt in Germany and Austria. In proportion as the university teaching of everything connected with the study of our planet and its inhabitants attains an increasingly higher level in

the universities of these two countries, the need is being felt to raise the level of geographical education in the Gymnasia and Realschulen. At the same time, the demands which have been put before the teacher of geography have lately been widened on the continent so as to require from him acquaintance with a number of natural and anthropological sciences, while the question as to the methodics of geographical teaching altogether, and the general aims which it has to keep in view, has lately been the subject of thorough discussion at several geographical congresses.

The result has been to create amongst the teachers of the secondary schools in German-speaking Austria the need of a collection of text-books dealing, in a not too bulky form, with the diverse branches of geography and its auxiliary sciences, as well as with the methods of teaching. The outcome of this movement is the important work of which the title is given above. The intention of Prof. Max. Klar is to bring out a collection of some thirty different works, covering something like 5000 pages and costing about £6, which would deal with all the just-mentioned subjects in a condensed form. Such a work could evidently not be written by one man, and the collaboration of a number of men of science, some of whom are well known to the geographer, has been secured. Thus we notice among them Dr. Siegmund Günther ('History of Earth-knowledge'), Dr. Julius Mayer ('Heimat-Kunde'), Dr. Wilhelm Trabert ('Climatology'), Dr. Heinrich Schurtz ('Ethnology'), Dr. Alfred Kirchhoff, and many others.

In Prof. Klar's 'Erdkunde' the first two monographs are given to the history of geography and of geographical teaching. The methods of teaching are discussed next ('Methodics' and 'Heimat-Kunde'). Astronomical geography, the astronomical determinations of geographical co-ordinates, the nautical sciences, and chronology, form the contents of the next five parts. The next division is devoted to physical geography (including terrestrial magnetism), the earth's crust (a geological compendium for the geographers), the rivers and the ocean, meteorology, geo-botany, and geo-zoology. The sixteenth and seventeenth parts are devoted to ethnology and folk-lore, the eighteenth to geographical terminology, and the nineteenth to historical geography. The next two parts deal with political and economical geography. The methodics of topography and topography itself, geodesy, and cartography occupy the next three parts. And finally, in the last three parts, maps, reliefs, and other auxiliaries of geographical teaching are considered, as also geographical school collections; a separate fascicule contains problems that may be given for exercise in different portions of geographical teaching.

We have now before us seven parts of Prof. Klar's collection, and judging from them we can say that it will be most valuable for its purpose.

In a series like the geographical encyclopædia which we have before us, one has to direct his attention, first of all, to the work of Dr. Anton Becker, 'Methodik des Geographischen Unterrichtes. Ein pädagogisch-didaktisches Handbuch für Lehramts-kandidaten und Lehrer' (Part iii.). This small work of only ninety octavo pages will be found an extremely valuable aid by the teacher of geography. One might take exception to the too great importance attributed to Heimatkunde —the more so as the pupil of an intermediate school has necessarily already acquired in the primary school some knowledge of the aspects of the land, and will certainly acquire a greater interest in earth-knowledge by being told of distant lands and having pictures of distant landscapes shown to him. With the plentiful supply of illustrated periodicals, this would happen without the interference of the teacher. Therefore, the statement to the effect that "before all,

the fundamental conceptions of geography must be developed *only* from the contemplation of the locality," may be considered as too categorical. However, Dr. Becker gives so many references to the literature of the subject, that the reader may himself introduce the necessary limitations to the above statement. On the other hand, we find in the little work before us so much excellent advice given to the teacher, that we should be inclined to produce quite a number of quotations from it. Here is, for instance, one concerning the importance of the so-called "Kultur-geographie" as a means of general education—

"Nowhere does one find such an opportunity to point out the mutual interaction of geological, orographical, and climatic conditions, and their influence upon the conditions of human life and human work, as one finds here. The pupil has the possibility of getting a thorough acquaintance with a number of conceptions which are now continually referred to as 'war-cries' in our daily press. Here he learns about the different activities of man which are links of a great chain and serve the needs of all, as well as human progress as a whole. He learns to hold every sort of handiwork in esteem. While he gets an insight into the foundations of the economical state of a country, he learns not to over-estimate the conditions prevailing in his own country or abroad; and while he studies the economical conditions of a country, he obtains a clear comprehension of the history of its inhabitants."

Notwithstanding the compact size of this work, all the main points of geographical teaching, and the chief aids for this teaching—maps, globes, surveys, drawings, collections, etc.—are dealt with.

Part vii., "The Astronomical Determination of Geographical Co-ordinates," by Eugen Gelcich, will be most welcome to the geographer, as it deals with this important subject in a very thorough way, in a compact memoir of 126 pages. The different methods are treated without resorting to higher mathematics.

"Geodesy" (Part xxiii., 417 pages) is treated by Dr. Norbert Herz. This work was begun by Dr. H. Hartl, but was left unfinished by him at his death. As a text-book of elementary and higher geodesy the work of Dr. Herz has undoubtedly a great value, the different methods, as well as the instruments, being described with great lucidity, and illustrated by excellent diagrams, while those geodetical theorems which require the knowledge of the differential and integral calculus are not omitted, but are dealt with in small-type footnotes. Fully recognizing the necessity of such a detailed work in Prof. Klar's collection, we nevertheless ask ourselves whether a short summary of the subject, giving only a broad idea of the methods of geodesy, would not be equally desirable in a collection destined for the secondary schoolmaster. Moreover, we shall permit ourselves to point out that the unfortunately too-much-neglected measurements of altitudes might have been dealt with in some greater detail in the large work. A traveller who brings no hypsometrical material from the country he has explored, does not deserve the name of a geographer. Besides, something may also be said of the immense amount of enjoyment which can be obtained by schoolboys from altitude measurements during their pedestrian and cycling excursions. So we hope that this important subject will be dealt with in more detail under the head of topography.

Both volumes dealing with Ethnology and Folklore are already out. The former was written by Dr. Heinrich Schurtz, whose work on the secret class-organizations among savages was so much appreciated by specialists, but whom untimely death has carried away from our ranks during the printing of this last book in Prof. Klar's series. In the small space of 180 pages Dr. Schurtz

has given such an excellent compendium of his branch that it ought to be translated into all languages.

'Folklore: its Importance, its Aims, and its Methods,' by Dr. R. Fr. Kaindl, is an attempt to popularize this branch of research, and to define at the same time, in a scientific way, its proper methods of investigation and its relations to ethnology and anthropology. After having indicated what is being done in this direction in different countries, the author discusses the part that folklore plays in the development of our social conditions and the bearing of these studies on history. He concludes by giving detailed instructions and inquiries (some of them with explanatory drawings) for those who might undertake folklore studies, and finally discusses the scientific treatment of folklore materials, and the place of folklore in the school curriculum.

An extremely useful little work is that of J. W. Nagl on geographical names. The author, who is well acquainted with the already growing literature of this subject, gives explanations of geographical names with the Chinese, the Japanese, the Turkish stems, the Hebrews, the Phœnicians, the Magyars, and all European nations, and he deduces the general rules which may be observed in the formation of geographical names with different nations.

An important part of Prof. Klar's 'Erdkunde' is the volume (300 pages) given to Historical Geography by Dr. Wilhelm Götz. The author fully understood the impossibility of adequately dealing with this immense subject in a small volume, the more so as the very foundations of this branch of science are not yet settled. Therefore he only undertook to give a series of illustrations of the influence of geographical surroundings on the historical development in different regions of the Earth. One series is taken from the history of Middle Europe, and the other from the Mediterranean region. As a first attempt in this direction the work of Dr. Götz deserves full praise; but we must point out that the conquests of the forests and marshes of Middle Europe by man in the barbarian period, the influence of the village community, and especially the conquest of the country for civilization that was accomplished by the mediæval cities, are not brought sufficiently to light. It must also be said that none of the general preparatory works which are mentioned by the author could have been a safe guide in this branch of knowledge, which requires yet a great deal of original research. We hope, however, that the forthcoming large work of Elisée Reclus, in which man and his geographical surroundings are discussed at length, will be epoch-making in this direction.

We shall not fail to mention the other parts of Prof. Klar's great undertaking as soon as we have received them.

P. KROPOTKIN.

THE MONTHLY RECORD.

EUROPE.

The Underground Waters of North-West Yorkshire.—The report of a joint committee of the Yorkshire Geological and Polytechnic Society and the British Association, formed for the purpose of continuing the investigations carried on by the former body on the underground waters of north-west Yorkshire, is printed in the *Proceedings* of that society for 1904 (N.S. vol. 15, pt. 2). The bulk of the report has been prepared by Mr. A. R. Dwerryhouse, on whom the greater part of the arrangements for the prosecution of the work devolved, and who gives both a general sketch of the geography and geology of the district investigated

(that around Ingleborough), and a summary of the results obtained as regards a knowledge of the circulation of the underground waters. Ingleborough, as is well known, forms an almost isolated patch of high ground, separated from surrounding hills by deep valleys, and the area offers advantages for an investigation of the character in question both for this reason, and because of the large number of streams which flow in part beneath the surface. The summit consists of millstone grit resting upon a series of shales with thin limestones and grits (Yoredale rocks), which in turn overlie 600 to 700 feet of mountain limestone. This rests unconformably on a floor of Ordovician and Silurian rocks, the surface of which consists of a series of ridges with intervening valleys. The rain falling on the porous millstone grit percolates through its mass until it is thrown out, on reaching the underlying shales, as a series of springs, the water of which is again absorbed into the fissures of the limestone, and again issues at its base. The flow of the underground waters was tested by the introduction of various substances into the water-sinks (fluorescein being found by far the most satisfactory), and the connection between the points of disappearance and emergence was satisfactorily determined in many cases. Thus, in the case of the famous Gaping Ghyll, a direct connection between this and the spring at Clapham Beck was established, the water being found, at the time of the experiment, to take five clear days to pass along its underground course over the mile that intervenes between the two points. The report gives a detailed description, with maps and sections, of the various "pots" and other features, the general conclusion as to the flow of the waters being as follows: The flow is radially outward from the high ground, but is profoundly affected by the direction of the joints in the limestone. These usually pass through one bed only, but occasionally, as in Mere Gill hole, the limestone is fractured from top to bottom. The irregularities in the floor of Silurian and Ordovician rocks form underground watersheds which may determine the direction of flow. Some, at least, of the caves and pot-holes are of pre-glacial origin, since it has been found that the original outlet (as, *e.g.*, in the case of Alum pot) was in an old valley now partly filled with glacial drift. Owing to the influence of the joints in the limestone, there are instances in which streams are carried beneath a surface watershed, to emerge in a different drainage basin from that in which they took their rise, while crossings of streams at different levels also occur.

The Midlands Earthquake of April 23.—An earthquake of considerable strength visited the north midland counties on the morning of Easter Sunday at about 1.36 a.m. The epicentre probably lies in the district where the counties of Nottingham, York, and Lincoln meet, and not far from Doncaster and East Retford. The disturbed area includes the whole of the counties of Lincoln, Nottingham, Derby, Leicester, and Rutland, and the greater part of Yorkshire, Staffordshire, and Northamptonshire, and even extends into Lancashire, Warwickshire, and Norfolk. A first estimate gives the extent of the area shaken at 20,000 square miles. Some slight damage to buildings is reported from the neighbourhood of the epicentre, and the Great Northern Railway station at Doncaster was somewhat seriously injured. "For about 50 yards on the up side the roof of the platform and the smoke-box over the nearest line of rails became partially detached, the pillars supporting the smoke-box leaning towards the metals, and the pillars supporting the platform roof leaning towards the station buildings to a total extent of about 8 inches." Most of the seismographs in this country are affected only by the long-period waves from distant centres, and therefore failed to register the disturbance, with the exception of an Omori horizontal pendulum at Birmingham, which recorded a series of minute tremors lasting altogether for about a quarter of a minute. The earthquake is being investigated by Dr. C.

Davison (16, Manor Road, Birmingham), who would be glad to receive accounts of the shock from any part of the disturbed area.

The Earthquake in France and Switzerland on April 29.—At about 1.45 a.m. (Greenwich mean time), a shock, comparable in strength with some of the strongest experienced in this country, was felt in the south-east of France and west of Switzerland. The epicentre appears to be in Savoy, in the neighbourhood of Chamouni and Argentière, where the walls of many houses were cracked. That the damage was not excessive, however, is evident from the fact that in this district it is estimated to amount to no more than £4000. The disturbed area contains not less than 50,000 square miles, extending from Basle to near Aurillac, and from the neighbourhood of Nevers and Dijon to Turin and Domodossola. The shock was recorded by seismographs at Heidelberg, Pavia, Padua, Ferrara, Modena, Ischia, and elsewhere.

The Simplon Tunnel.—The economic bearings of the Simplon tunnel are discussed in Mr. Sargent's article in the present number (*ante*, p. 654), which, however, is not concerned with the technique of the great undertaking, or the relation of the tunnel to the physical features and geological structure of the region through which it passes. A few notes on these points may therefore be given here. The tunnel differs from other great Alpine tunnels in its comparatively low level, no attempt being made, as, *e.g.*, in the case of the St. Gothard, to attain, by means of engineering feats, an elevated point of vantage for the attack of the mountain range. It leaves the Rhone valley just above Brieg, at an elevation of only about 2260 feet above the sea (the northern entrance to the St. Gothard tunnel is at a height of 3380 feet), and strikes south-east by a straight course for the Italian village of Iselle, in the Val di Vedro (above Domo d'Ossola), where it makes its exit at an elevation of 2080 feet. One result of this low level is the immense length of the tunnel, which places it at the head of all tunnels yet pierced in this respect. It reaches 21,577 yards, or just over $12\frac{1}{4}$ miles, as compared with 16,393 yards ($9\frac{1}{4}$ miles) in the case of the St. Gothard, and 13,279 yards (7 miles 959 yards) in that of the Mont Cenis. The Simplon road, in the wide circuit it makes to the south-west, diverges a long way from the line of the tunnel, the nearest point of which is over 3 miles to the north-east of the Simplon pass. The highest point of the surface immediately over the tunnel (about 9000 feet) is on the Swiss-Italian frontier, close to the Furggenbaum pass, but the summit of Monte Leone (11,683 feet) lies less than a mile off the direct line. An excellent sketch of the geological structure of the range at this point, and especially of the circulation of the underground waters which have formed one of the greatest difficulties to be overcome during the construction of the tunnel, was given in *La Géographie* for February, 1905, by Prof. H. Schardt, one of the expert advisers employed by the Swiss Government. A geological section there inserted shows the exceedingly complicated arrangement of the geological formations, which may be subdivided into three groups. To the north is a zone of Jurassic schists (*schistes lustrés*) pierced here and there by dolomitic limestone of Triassic age. In the centre is a much contorted mass of crystalline schists and gneiss (with intercalated calcareous schists, etc.), forming the upper part of the Monte Leone massif. To the south, again, there is another zone of gneiss (that of Antigorio), which has hitherto been thought (erroneously) to compose the core of the massif. As a matter of fact, the Monte Leone gneiss lies in a basin formed by the *schistes lustrés*, such have been the contortions to which the formations have been subject. The circulation of the underground waters at great depths has been found to be closely bound up with the fissuration of the rocks, and the most copious springs almost always issued from soluble rocks, especially the limestones. The temperature of the

rocks was found to be profoundly affected by the circulation of the water, which frequently had the effect of lowering the normal temperature, so that the highest encountered was not beneath the culminating point of the surface, but at a point some distance to the north-west, whither little water had found its way. In the zone of most copious springs, in the southern segment of the tunnel, temperatures of 63° Fahr., and even 59° were found, where they would normally have been as high as 95° to 100°. Many springs, of which the volume was at first great, gradually decreased until a permanent discharge was reached, the mineral constituents, and frequently the temperature also, showing a similar decrease. This is explained by the fact that the water in the lower parts of the fissures had been more or less stagnant, until drained away by the piercing of the latter. From a careful study of all the springs observed (there were over forty in each of the parallel galleries), Prof. Schardt divides them into three groups: (1) hot springs, at a temperature higher than that of the rock, and tending to increase with time; these are strongly impregnated with gypsum and iron; (2) springs at about the temperature of the rock, always more or less ferruginous, but varying as to the amount of gypsum; (3) cold springs, very copious, with little iron, but much gypsum. He describes in detail the method of circulation and the temperature régime of the several classes. An important point brought out is the fact that with the *decrease* of rock-temperature owing to the access of water at one point, there is an *increase* in parts abandoned by the water, so that a general thermal balance is maintained.

Northern Germany as known to the Ancients.—An interesting study of the gradual acquisition of knowledge of Northern Germany by the Greeks and Romans has been brought out by Herr D. Detlefsen in the valuable series of monographs ('Quellen und Forschungen zur alten Geschichte und Geographie,' No. 8: Berlin, 1904) edited by Prof. Sieglin of Berlin. The author is already known (among other writings on historical geography) for his edition of the 'Natural History' of Pliny, one of the most important bases for the present study; but he now presents a comprehensive general view of the subject, as elucidated by a comparative study of all the early writers who have touched upon it. He gives many references also to modern German authors who have worked in the same field, though the views of writers in other languages (*e.g.* Bunbury in English) are not discussed. In many instances he brings forward new explanations of doubtful questions, which though sometimes rather venturesome, have generally much in their favour, the authority for the *variæ lectiones* of the old texts being carefully weighed. Among the most interesting points discussed is naturally that of the information given by Pytheas on these northern regions. Like Bunbury and Sir C. Markham (*Journal*, vol. 1, p. 519), the author considers the "æstuarium oceani" of that voyager to be the portion of the North sea washing the German coast, the phrase used corresponding well with the "Wattenmeer" of the Germans. The name of the dwellers on this coast ("Guionibus" of Pliny, according to the best MS.) he explains plausibly as identical with the "Inguæones," elsewhere placed by Pliny in the same region; holding that the reading "Gutonibus" is unsuitable, since no early account places the Goths in this region. The first syllable of the word would seem to have been first taken for the preposition *in*, and afterwards dropped out as a meaningless interpolation. For the name of the estuary he adopts the reading "Metuonidis" in the place of the more commonly accepted "Metonomon," and ingeniously derives the word from the "matte" or "mede" (meadow), which is a common element in the place-names of this region, the termination *-is* being that commonly used by the Greeks to designate a region. The island of Abalus, whence amber was obtained, is identified with Heligoland, which was once

much larger than it is now. The Basilia and Baunonia of Timæus are both considered identical with the Abalus of Pytheas, while the Basilia of the latter was a more remote land, of which only a vague rumour had reached him. Other Greek navigators followed Pytheas, and of their voyages we seem to have an indication in the fabulous stories related of men with ears large enough to cover them, and the like. The accounts of Xenophon of Lampsacus show a widening horizon, and in his Balcia, as well as in the Basilia of Pytheas, we seem to have an indication of southern Sweden, long considered to be an island. His "Lutmiorum insula" is considered, with some show of reason, to be a misreading for "Latriorum," *i.e.* the "Latris" elsewhere spoken of by Pliny as an island to the east of the Cimbrian peninsula. The next important authority was Philemon (about 100 B.C.), whose lost work probably described the whole of Northern Europe, and who knew of the northern part of Jutland, the sea bathing its shores ("Morimarusa"), and probably the southern extremity of Norway. Eastward his knowledge seems to have extended to the amber region of the Samland. We next hear of the Codanus Sinus with the island of Scatinavia, or Codannovia, the name Codanus being somewhat boldly identified with the Katte(n)gat, while the island no doubt once more represents southern Sweden. The puzzling statement of Pliny that its inhabitants, the Hilleviones, called it a second world, is plausibly explained as really referring to the ideas of the Greeks, thus showing an analogy with the current notions regarding Taprobane. From this time onwards new names are constantly occurring, the Greeks having now given place to the Romans as explorers and chroniclers. The paper concludes with the picture of these regions supplied by Ptolemy.

ASIA.

Sechuan.—In a report ('China,' No. 5, 1904) extending to 101 pages, and supplemented by two maps, Consul-General Hosie embodies a comprehensive and detailed account of the agricultural, animal, and mineral products, raw and manufactured, of the province of Sechuan. Incorporating much that is new, and marked throughout by the use of first-hand information, the paper is the best guide to the whole material economy of the province that has yet appeared. Of the province, 167,000 geographical square miles in area, constituting one of the richest portions of the Chinese Empire, the western half is very mountainous, sparsely peopled by aboriginal tribes, and little cultivated except in its valleys, into which the Chinese have penetrated. The eastern half constitutes the "Red basin," having a thick surface layer of red and grey or yellow sandstone. It is surrounded by high mountain ranges, through which the Yangtze, forcing an eastern passage, has carved magnificent gorges. With the exception of the plain of Chengtu, 90 by 40 miles, there is very little level ground. Its valleys rise in many places to over 1000 feet above sea-level. One of the most valuable assets of Sechuan is salt, found everywhere, but most richly in the Red basin at depths of 30 to 2000 feet. Besides satisfying its own requirements, the province also exports an immense surplus. The most populous part is the plain of Chengtu, comprising seventeen cities, the population all the same being essentially rural. All eastern Sechuan is dotted with farmhouses, hamlets, villages, and market towns. The population of the capital is estimated at 500,000; that of the province at 45,000,000. The climate is exempt from extremes. In summer 95° Fahr. is a fair average maximum; in winter the temperature seldom falls below 35°, frost being very rare. There are light rains in January, February, and occasionally March and April; heavier rains, beginning in May, continue through June and July. The rainfall needs, however, to be supplemented by irrigation, the methods of which are lucidly described. No less necessary is manuring, for which everything possible

is utilized. Rice is the most important food-crop, and its granary is Chengtu plain with its never-failing water-supply. Red rice is cultivated in the mountainous districts. Glutinous rice, 11 per cent. dearer than ordinary rice, constitutes 20 to 30 per cent. of the total rice cultivation. From it are manufactured sugar, toffy, and a weak spirit. Next in importance to rice is wheat. The best flour is manufactured in Mien-chu Hsien, north of Chengtu plain. Barley is cultivated in the hilly regions more for spirits, ferment, and cattle-feeding than for human food. Other cereals are millet, Italian millet (*Setaria ital.*), a summer hill crop for feeding birds, maize, buckwheat, oats, pearl barley, and another grain which the report calls *Panicum Crus-galli*, L. Most of these cereals are made also into spirits. Next to cereals in importance for feeding the population is pulse. A list of forty different fruits is given, with their centres of production. The medicines of Sechuan recall the heterogeneous mixtures current in mediæval and later Europe. To pass over the vegetable medicines, 189 of which are enumerated, there figure among the animal medicines "Exuviæ of cicadæ," "dried silkworms," "cockroach dung," and other like choice ingredients. The chief obstacle to the prosperity of Sechuan is the difficulty in the way of the rapid disposal of its products. Steam communication on the upper Yangtze from Ichang to Wan Hsien is pronounced impracticable. Junk communication, on the other hand, labours under necessarily heavy freights, under which a case of kerosene oil, *e.g.*, selling in Hankau at $3.40, costs in Chengtu $10.30, and a tin of sugar worth 60 cents in Shanghai costs $3.40 in Chengtu.

Early Mapping of Korea.—In connection with the note on this subject in the April number (p. 456), a correspondent calls attention to the documents on Korea printed by Hakluyt in his 'Principal Navigations' (Maclehose's reprint, vol. 11, p. 422), in the title to which it is stated that the country was "called by the Portugales Coria, and by them esteemed at the first an iland, but since found to adjoyne with the maine not many dayes journey from Paqui, the metropolitan citie of China." This makes it the more singular that the Dutch cartographers, who based their map of this region on Portuguese sources, should have held so long to the erroneous representation of Korea as an island. It also exemplifies the up-to-date nature of the information collected by Hakluyt.

AFRICA.

The British East Africa Protectorate.—The report of Mr. Hobley on the East Africa Protectorate for 1903–4 ('Africa,' No. 15, 1904) records, on the whole, satisfactory progress. It is shown that the most striking features of the year were the influx of European settlers into Kikuyu, the rift-valley, and Mau highlands, and the growing prosperity of Kisumu and Kenya provinces. The rainfall during the year in certain parts of the protectorate was above the average, notably in the region between Nairobi and the lake and in the Lumbwa country, while in the district below Nairobi a deficiency in the rainfall is recorded. Sleeping sickness is still prevalent round the shores of Lake Victoria, and appears to be extending south in the direction of German territory. The township of Kisumu has been removed to the south side of Ugowe bay, many new buildings having been constructed and roads made in the vicinity. Much, however, remains to be done to improve the health of the place. Two new stations have been constructed in the Kisumu province—one at Karungu, to open up the Ugaya district, and the other at Soba. With regard to trade, a decrease in imports is notified, mainly due to the difference in Government goods, while a steady increase in exports is recorded. A Forest Department was organized during the year, and progress has been made in the work of demarcating and examining forest areas and establishing nurseries in different

parts of the protectorate. Appended to the present issue is a series of valuable reports, one dealing with the subject of sleeping sickness, and the others with the agricultural capabilities of the several districts of the protectorate. The soil of the rift-valley is described as good dry grazing land, more suitable for stock-raising than for crops, although during the wet season it is thought that wheat, maize, and potatoes, etc., might be successfully grown. On the other hand, the Mau plateau, possessing a richer soil and heavier rainfall, seems better suited for the production of crops. The best lands for settlers in the rift-valley appear to be those on the Mbaruk river and on the south of Lake Nakuru. The Tsavo plateau, stretching towards Kilimanjaro, is said to be a locality of great promise both for agricultural and stock purposes. The country in the neighbourhood of Fort Hall, in the Kenya province, seems well adapted to agriculture, and worthy of the attention of cotton-growers.

M. le Roux's visit to Lake Zuai, Abyssinia.—The inhabitants of the islands of Lake Zuai, as is well known, long maintained a semi-independence of the Abyssinian Negus under a chief of their own. In his endeavours to establish his supremacy in all parts of his wide dominions, Menelik in 1894 sent an army against these people, with the result that their resistance was speedily overcome and their king taken as a prisoner to Addis Ababa. With a view to still further establishing his influence, Menelik confided a mission to the French writer and traveller, M. H. le Roux, to visit the lake, make a study of the people, and report on the antiquities preserved among them, on the possession of which their claim to independence, based on a traditional connection with King Solomon, largely depended. In spite of the opposition of the priests, M. le Roux, who lately gave an account of his journey before the Paris Geographical Society (*La Geographie*, 1904, No. 1), was able to visit the islands and examine their churches and the palace of the king. The lake is impregnated with soda, and this is at times so abundant that the fish in it die. At sunset the water shows violet and mauve tints, which contrast strongly with the reddish soil of the shores and islands. Of the latter the three principal lie towards the south-west, and are of eruptive origin. Their names are Haisut, Famat, and Debra Sion (Mount Sion), called also Princesses' island. Fig trees, euphorbias, etc., grow on the islands, where cotton is also cultivated. Goats, sheep, and a few cattle are kept. The population of the islands is at present from 4000 to 5000 souls, though formerly it reached 15,000. All speak the "laki" or rowers' language, a mixture of Abyssinian and Tigrean, but two races are represented, the first of which, the Wato, still pagans, recall the ancient Egyptians as shown in the papyri. Tradition has it that they migrated from Egypt in the time of Joseph. The other race is related to the Gurage, and is said to have come from Tigre about 340 B.C. It reproduces the purest Jewish type. One only of the churches was open, the others having been closed since the deportation of the king. The inner meaning of Christianity has been quite lost, and the religion is a sort of exalted fetishism. The manuscripts in the possession of the priests are the Gospels and other religious or historical books. In the palace a fire has been kept constantly burning since the king's departure, and his return is earnestly prayed for by the people.

AMERICA.

Internal Commerce of the United States.—An article contributed by Prof. Hauser to the *Annales de Géographie* (No. 73, XIV. Année) on the "Internal Commerce of the United States" is noteworthy, not so much as a summary of facts, as for its causal elucidation of the varied factors which come into play. The magnitude of the land, it is pointed out, imposed on the nation appropriating it the

problem of conquering space—a problem solved in the first place by the railway. Another fact to be reckoned with was the variation of its soil and climate—the vast cultural zones each extending over an area not to be measured by European standards, and devoted almost exclusively to one or two cultures. It is shown how in France the elements of human life are not rigorously differentiated over widely separated localities, but are as a rule intermingled locally, so that the products of France are interchanged internally between places near one another, or at farthest but 600 miles apart. While France has thus in itself all the necessaries of life, the United States, of sixteen times the area of France, does not form sixteen Frances, each capable of independent economic development. Had such been the case there would have been no federation, or none of any permanence. Each unit would have followed its own development and constituted a state by itself. It is the pronounced specialization in production of its diverse regions and their consequent inter-dependence that has determined the union. Embodying all climates, and so all products, the United States could afford to be independent of the outer world. Its inter-state trade is therefore thirteen times the value of its foreign. Hence its protection and its felicitous indifference for nearly half a century to the development of its mercantile marine. In their no less strict causal connection the article sets forth the respective directions and volumes of the internal currents of commerce, the exploitation of navigable ways, the history of development of the great railway lines, and of the coasting trade. With the growth of population already tending to approximate to the rate of the growth of commodities, with the increasing demand for luxuries and extra-American products, and with the enormous increase of industrial production demanding oceanic trade, the period during which its internal trade has constituted the predominant note of the economy of the United States seems, to the writer of the article, to be drawing to a close. Though the scope of the article does not include an appreciation of the reaction of America on its colonizers, the reciprocal relation between man and geography constitutes the thread running through the whole, and linking together all the data put forward.

Dr. Hoek's Exploration in Bolivia: Erratum.—*Geographical Journal* for May, p. 500, illustration, for "Quebrader" read "Quebrada."

AUSTRALASIA AND PACIFIC ISLANDS.

Dr. A. Agassiz's Cruise in the Pacific.—News has just reached this country that Dr. Alexander Agassiz has completed his great cruise in the Eastern Pacific in the *Albatross*, alluded to in the May number of the *Journal*. He joined the ship at Panama on November 2, 1904, and returned to San Diego, California, on March 12, 1905, having been at sea for over one hundred days. During this time he ran some important lines of soundings across a part of the Pacific where information regarding the depth of the ocean was much required. He took some very good serial temperatures developing the Humboldt current, which carries with it most of the pelagic forms of life. Where there was no current there was no pelagic life to drop to the bottom, and, indeed, outside the Humboldt current far from land he found very few Benthos organisms. He discovered a ridge between the Galapagos islands and Manga Reva, which he named "Garrett ridge," after the commander of the *Albatross*. A large stretch of the ocean floor in the region between the Galapagos and Easter inland and Callao was found to be covered by manganese nodules to such an extent that he was quite overwhelmed with them. Where the manganese nodules occur comparatively little was brought up in the trawl. In fact, this manganese nodule area, and the similar area traversed by the *Challenger* farther to the west, may be put down as the desert regions of the ocean. All the samples of bottom muds collected are to be forwarded to the Challenger Office in Edinburgh for examination and description.

A Primitive Tribe in British New Guinea.—In the Annual Report on this possession for 1902–3, the item of most interest geographically is an account of a visit by the acting administrator to a small tribe, the "Agaiambo," inhabiting a series of swamps not far from the lower waters of the Barigi river, in the north-eastern division. Two of their villages were sighted, and one man and a woman induced to leave their boat and step on shore. Once fairly numerous, the tribe has been recently reduced by an epidemic to about forty persons. Never leaving their morass, their feet bleed in the attempt to walk on hard ground. From time immemorial they have been living in this swamp. The man who landed had a good chest, thickish neck, and arms to match, but the lower parts of the body, especially the legs, were disproportionately small. The feet, short and broad, were very thin and flat, with weak-looking toes. In the woman, the toes, long and slight, stood out, apparently jointless, from the foot. The man's skin above the knees was in loose folds, and the sinews around the knee ill developed. The muscles of the shin were much better developed than those of the calf. Placed alongside a Barugi native of the same height, the marsh-man was about 3 inches shorter at the hips. In figure and carriage, the man looked more ape-like than any human being the administrator had ever before set eyes on. The woman, of middle size, was more slightly formed than the man, but her legs were still short and slender in proportion to her figure. The houses of the nearer village were built on piles, at a height of about 12 feet from the surface of the water, but one house, at a village three-quarters of a mile off, was 3 or 4 feet higher. Small, long, and narrow, with no outrigger, their canoes are hollowed out to a mere shell for the sake of buoyancy. Aquatic plants in the water would oppose the progress of craft of any width. Though the canoes are of the round form of the log and very unstable, the owners pole them along easily, standing up in them. The people are expert swimmers, and live on wildfowl, fish, sago, and marsh plants, and on vegetables procured from the Barugi in exchange for fish and sago. They keep a few pigs on platforms built underneath or alongside their houses. Their dialect is the same as that of the Barugi. The report gives, on the whole, a satisfactory account of progress in the matter of trade, communications, and the like.

POLAR REGIONS.

The Scientific Results of the Swedish South Polar Expedition.—The prospectus has been issued in Stockholm of an important publication dealing with the scientific results of the Swedish expedition under Dr. O. Nordenskjöld to the region of Graham's Land in 1901–1903. The observations made by the scientists of the expedition were, as is well known to our readers, very extensive and important, and geographers will welcome their publication in a style befitting their value. According to the proposed arrangements, the work will form seven quarto volumes, extending to at least 3000 pages, with a profusion of maps, diagrams, and plates. Of these, vol. 1 will contain the general description of the voyage, the more strictly geographical results, and those in the field of terrestrial magnetism, etc. Vol. 2 will deal with meteorology; vol. 3 with geology and palæontology; vol. 4 with botany and bacteriology; and the last three with zoology. The work will appear in sections, each embracing one monograph, and it is to be completed by 1909. A part of the expense will be borne by the Swedish Riksdag, but as further funds will be necessary, the work will be issued to subscribers at the price of £15.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Determination of the Longitude between Greenwich and Paris in 1902.—That there should exist at the present time any uncertainty as to the

correct difference of longitude between the Greenwich and Paris observatories will be a surprise to most persons, yet such is the case, although the limit of possible error is, of course, extremely small. The determination of 1888 gave a resulting difference of longitude of 9^m $20^s{\cdot}85$, and that of 1892 9^m $20^s{\cdot}79$, the discrepancy between the two being $0^s{\cdot}06$ of time, or $0''{\cdot}9$ of arc, which is equal to a distance of about 63 feet. In view of this discordance it was decided at the International Geodetic Conference of 1898 that a redetermination was desirable, and it was arranged by M. Lœwy of Paris and the Astronomer-Royal at Greenwich that this should be undertaken by the two observatories of Paris and Greenwich; but, owing to other important work on hand, it was found impossible to carry out the project until 1902. An interesting account of the manner in which the redetermination was conducted is given by the Astronomer-Royal in the *Monthly Notices of the Royal Astronomical Society* for January last, in which are described the instruments used and the observations made by the two English observers, Mr. Dyson and Mr. Hollis, who had been specially selected for the purpose. The results of the two French observers, MM. Bigourdan and Lancelin, were given in the *Comptes Rendus*, vol. 139, p. 1014, and found to differ only by $0^s{\cdot}042$ of time from that obtained by the English observers. The instruments used were the four portable reversible transits belonging to the Royal Observatory, which had been used on the previous determinations, and the observing stations were the Transit Pavilion and an adjacent wooden observing hut in the front court at Greenwich, and stations in the grounds south of the observatory at Paris, a little to the east of Cassini circle. To ensure the best results, each observer took observations both at Greenwich and Paris, but kept the same instrument throughout. The observations were made in the spring and autumn of the year, and extended over thirty-nine nights between March 17 and May 3, and forty-one nights between September 21 and November 4. The clocks used were the standard sidereal clocks of the two observatories, and the time of transmission in one direction of the telegraph signals was found from the mean of the spring observations to be $0^s{\cdot}021$, and from the mean of the autumn observations $0^s{\cdot}022$. Every possible precaution was taken to ensure accuracy, and the agreement in the results is as satisfactory as could be expected. The differences of longitude obtained by the English observers are as follows: spring observations, 9^m $20^s{\cdot}977$—probable error, $\pm 0^s{\cdot}011$; autumn observations, 9^m $20^s{\cdot}911$—probable error, $\pm 0^s{\cdot}004$. Applying the proper weights to the spring and autumn series of observations as above, and taking the resulting mean, the final difference of longitude between the Greenwich and Paris observatories becomes 9^m $20^s{\cdot}932$, with a probable error of $\pm 0^s{\cdot}006$, while the final resulting difference of longitude obtained by the French observers is 9^m $20^s{\cdot}974$, with a probable error of $\pm 0^s{\cdot}008$. The difference between the two being only about 43 feet.

American and Austrian Research in Geomorphology.—We are indebted to Dr. K. Peucker, of Vienna, for a cutting from *Die Zeit* for April 15, 1905, containing an article by Prof. Penck on recent geomorphological research carried out under the auspices of the Carnegie Institution in Washington,* especially that of the expedition under Prof. Bailey Willis in Eastern China. Prof. Willis has, since his return from China, been entrusted with the execution of further research into the history of European mountain ranges, and has lately visited Vienna in prosecution of his commission, giving some account of his work in China at a gathering of Viennese geographers, at which Dr. Cvijić was also

* The expeditions to Central Asia under Professors Pumpelly and Davis and Mr. E. Huntington have, it will be remembered, been also supported by this active institution.

present.* Prof. Penck expresses his admiration at the work accomplished by Prof. Willis's expedition, which paid especial attention to the form and structure of the mountains of Shantung as well as of the Wutai-shan and the Chinling ranges. A most minute plane-table survey of the region traversed was carried out by Mr. Sargent, of the United States Geological Survey, with the result that our knowledge of the topography of Eastern China has received valuable additions. Prof. Willis belongs to the school which assigns to vertical movements of the Earth's crust, rather than to folding, a predominant *rôle* in the moulding of mountain ranges as they at present exist, and he holds that the mountains of Eastern China form the remnants of an old warped mountain stump which has been quite recently elevated and subjected to the furrowing action of streams. This last uplift is, as regard portions of the area, placed *after* the deposition of the loess, which is held to have taken place during the glacial epoch. Prof. Penck points out that many of the American conclusions in regard to the history of mountain ranges have been reached independently by the Vienna school of geographers, who have for some time been devoting their attention to similar problems. Thus he himself had, at the St. Louis Congress last year, put forward a somewhat similar explanation of the history of the western Alps, while at the discussion which followed Prof. Willis's address there was a general disposition to regard many of the European ranges as the stumps, as it were, of old mountain systems newly elevated, with the accompaniment of dislocation and warping, though this has not yet been shown to be true of the Alps. It should be observed, however, that even in America the views of the new school have not yet met with universal acceptance, and that the possibility of a different explanation in certain cases does not seem excluded.

GENERAL.

An Oceanographical Course at Bergen.—For several years courses of instruction on oceanography have been held under the auspices of the Bergen Museum during the University vacation (August to September), and have been attended by scientific men from various countries. It has now been decided to continue these courses regularly, and that for 1905 will be given between August 8 and October 14, consisting, as before, partly of lectures, partly of practical instruction and assistance in laboratory work. Excursions for the practical demonstration of appliances and instruments will also be arranged. Those wishing to attend are requested to apply before July 1 to The Oceanographical Institute of Bergen Museum, Bergen, Norway. The fee charged (75 kr.) is roughly the equivalent of four guineas.

OBITUARY.

Paul Lessar.

The announcement of the death of M. Lessar will be received with regret by his many friends in this country. The name of Paul Lessar has of late years been so intimately associated with the stormy politics of Asia, that his eminent services in the field of geographical research are apt to be overlooked. He was born in Montenegro in 1851, and educated at Petersburg as an engineer. It was as an

* Prof. Willis has planned a journey to the "Iron Gates" and in the Balkan peninsula in company with Dr. Cvijić.

engineer that he was attached to Skobeleff's staff in Turkestan in 1878, to study the country in the interests of railway development. He was the first European scientist to carry explorations into the Trans-Caspian provinces with Komaroff in 1881, and subsequently, as agent to the governor-general of these provinces, he made a reconnaissance of most of the districts touching the Afghan border, penetrating to within a few miles of Herat.

This was accomplished at a time when the Perso-Afghan borderland was still subject to periodic raids by Turkman horsemen, and Lessar's adventurous rides across the frontier were attended with great personal risk. The result was the acquisition of that special geographical knowledge which, before the advent of the Russo-Afghan boundary commission in 1883 under Sir Peter Lumsden, gave the Russian Government such advantage in those political negotiations which ended in the appointment of the commission. During these negotiations Russian diplomats held the best of the trumps owing to their unchallenged information as to the geographical conditions prevailing in the disputed country, and this advantage proved to be almost disastrous to British and Afghan interests. Whilst the British Commission was waiting on the Russian Commission in the border country to the north of Herat in 1883–84, Lessar was well employed in London as an active agent in furthering the interests of the country of his adoption. Finding (as he explained to the writer) that "the politics of the average Briton in the afternoon were what he read in the paper in the morning," he made use of his pen and of his knowledge of the English language, and he succeeded in producing a marked effect on the politics of the Government of the day. The incident of Panjdeh was overlooked, and with it practically ended the mission of Sir Peter Lumsden, who was then recalled. It was subsequently that the protocol of September 10, 1885, was framed, laying down the line of the Russo-Afghan frontier, and with the succession of Sir West Ridgeway to the command of the British Mission the work of demarcation was at length commenced. It was as the political adviser of the Russian Commission that the writer first made the acquaintance of Paul Lessar, an acquaintance which ripened into a friendship, which lasted till the death of the Russian diplomat at Peking about a month ago. M. Lessar was a well-read and charming companion. He had that sincere liking for Englishmen which is common to most Russian gentlemen, and he was ever ready to explain his views as to Russian progress in Asia with the utmost candour. Naturally he regarded Russia as the final predominating power in the Asiatic continent; but he was content to regard this eventuality rather as an inevitable development in future history than as likely to be effected by any forcible expansion in the present. He was never an advocate for forcible measures. He even looked forward to an *entente* between Russia and England as a matter of mutual advantage, and was undoubtedly sincere in the professions of his belief that the linking together of commercial interests by the junction of the railway systems of Russia and India would inevitably promote peaceful relations between Russia and England. Community of interest was his panacea for present friction. He constantly expressed his regret that Englishmen travelled so little in Russia, and that they accepted the principle of antagonism to Russia as an article of national faith without troubling themselves to inquire whether the basis of it (the natural and inevitable expansion of Russia in Asia) really justified their convictions. There can be no doubt that the war between Russia and Japan was none of his making. As Russian minister at Peking (to which post he succeeded in 1901 from the appointment of Councillor at the Russian Embassy in London), there is every reason to believe that he would have averted that disaster had his advice been followed. Doubtless the results of that war proved to be bitterly disappointing to

so keen an advocate for the extension of Russian influence, and may have hastened his end; but he had never been in sound health since the days of privation and anxiety which he passed on the Herat frontier. The operation which resulted in his death would have been inevitable sooner or later, and he was well aware of it years ago. Paul Lessar had many friends in England, and few enemies; his friends will regret him deeply, and geographers will remember that with him has passed away the pioneer of exploration in that great lone land which stretches itself in sandy steppe and rugged upland from Herat to the Caspian sea.

T. H. H.

The scientific work of P. M. Lessar was well analyzed in 1884 by General Stubendorf, when the Russian Geographical Society awarded to the Transcaspian explorer a gold medal. In 1881 he was working in the Transcaspian region in connection with the building of the railway. He accomplished an important survey between Askabad and Serakhs, and returned to Askabad *viâ* Meshed, the Allah-Ekber pass, and Mahmed-abad. It was during these explorations that he noted the important fact of there being no definite rising of the land eastwards of the Caspian. He predicted that if a levelling was made from the Teke oasis to Khiva and Bukhara, there would be found places on this line where the surface will lie below the present level of the Caspian, just as such regions were found in the Sary-kamish depression, and he concluded that the Murghab and the Tejen rivers never could have discharged into the Oxus, but that they reached the Caspian sea directly, when this sea extended much further eastwards. The key to the solution of the Oxus problem was contained in this remark.

In 1882 Lessar made a second journey in order to explore the region between the Herirud and the Murghab, to the west of the route which had been followed by Shakespeare and Abbot in 1840–41. This journey upset all our previous conceptions about the mountain region which separates the valley of Herat from the land of the Turkomans. It appeared that to the west of the Murghab the Paropamiz becomes very much lower, and that the mountains rise once more to a great height only near the Herirud, under the name of Bokhut mountains. The absolute height of the Hombou pass which leads to Herat was found by Lessar not to exceed 3500 feet, and its elevation above the surrounding region was found to be only 900 feet. There would be no more obstacles for building a railway along this line than there is in the undulating regions of European Russia. From Kusan on the Herirud, Lessar visited Khorian, Meshed, and Zur-abad, thus exploring the routes in the west of Herat. In the same autumn he undertook an even more interesting journey with the view of exploring another route to the Herirud, leading through a still lower pass, the Karuan-ashan. Then, from Seraks he ventured, with five men only, to Merv; he stayed there for several days as a guest of the two khans, and, crossing the Kara-kums, reached the Amu-daria at Boyun-uzun. Next year he visited again the Kara-kums, and these two journeys laid the foundation of a scientific exploration of this extremely interesting desert.

Although all the journeys accomplished by P. M. Lessar were, so to say, mere reconnoitrings of a region which for such a long time had remained inaccessible to the Europeans in consequence of the Turkoman raids, Lessar succeeded, nevertheless, even during his rapid journeys, in enriching geographical literature with a mass of most valuable information; his training as a railway engineer, and his habit of keeping an eye upon the configuration, the altitudes, and the structure of the surface being of immense help to him in his rapid explorations. At the same time his reports were always full of extremely valuable ethnographical

observations. The unveiling of the Transcaspian deserts and oases to geography will thus always remain connected with the name of Lessar.

The reports on the journeys of Lessar were published in the *Izvestia* of the Russian Geographical Society for 1882–84. A translation of them was given in one of the parliamentary blue-books.

P. K.

CORRESPONDENCE.

Temperatures and "Glacial Reservoirs."

In his article on "Glacial Reservoirs and their Outbursts," in the May number of the *Geographical Journal*, M. Charles Rabot, on p. 545, quotes Dr. Jacob Guillarmod as having found daily maximums invariably above 32° Fahr., and seen the thermometer mount frequently to 68° Fahr., as also four times to 95° Fahr. while on the Baltoro glacier. It is not stated at what altitudes these temperatures were observed, whether on or near the comparatively low moraine-covered portions of the glacier, or at higher camps on snow and ice, nor under what conditions they were taken, nor whether they were sun or shade temperatures. We may, perhaps, infer the last, since, as my observations have shown, an ordinary thermometer would register at that season in that region from 120° to 145° Fahr. in the sun at midday, while the solar thermometer would show maxima of from 170° to over 200° Fahr.

At high snow camps it is usually difficult to find a shade suitable to taking temperatures in the middle of the day. The interior of a tent, when the sun shines, is not adapted to this purpose, as the temperature within it may be 20° or more higher than that of the air outside. As large a shade as possible should be obtained by improvising an awning of some thick material, which should project from the north side of the tent, and beneath which the largest available piece of luggage should be placed to rest the thermometers on to protect them from the radiation of cold from the ice beneath. This last precaution is also advisable in using the solar thermometer.

The maxima quoted by Dr. Guillarmod differ somewhat from those observed by me at the same season of the same year (1902), and again in 1903 on the Chogo Lungma glacier, which has practically similar weather conditions to those on the Baltoro.

During July and August at our base camp at 14,067 feet altitude, surrounded on three sides by glacial ice and snow, the highest shade maximum was 66° Fahr., noted on two occasions only, the average maximum on clear days being between 50° and 60°. Some of the comparative sun and shade maxima at this camp, taken at 1 p.m., when the sun's rays are usually hottest, were—sun 186°, shade 57°; sun 190°, shade 60; sun 192°, shade 59°; sun 195°, shade 52°. At a snow camp at 18,811 feet altitude at 1 p.m., sun 192°, shade 55°. At a snow camp on middle of glacier at altitude of 17,322 feet, sun 204°, shade 56°.

At these altitudes, where the air is much rarefied and comparatively free from moisture, the sun burns with greater power than near sea-level, where part of its heat is absorbed by the denser air before reaching the Earth's surface; but the heat brought by its rays is quickly dissipated by more rapid radiation, and cooled by contact with the great quantity of snow and ice, so that shade temperatures remain low. While the temperature of the sun's direct rays may be almost unendurable, snow and ice may remain hard frozen in deep shadow near by. Almost immediately the sun leaves a snow surface freezing begins. Shade temperature, even if considerably above 32°, counts for little as a factor in converting

ice into water on the higher parts of a glacier, as opposed to the cold contained in the ice itself. The chief agent in this process is the heat brought by the direct rays of the sun.

Even at an altitude as low as 8500 feet in the Shigar valley, far removed from any glacier, with the sun-thermometer registering 206°, the shade temperature was only 76° Fahr. It will be seen by the figures at our base camp that the highest shade maxima do not always coincide with the highest sun maxima, any more than they do at lower altitudes, varying undoubtedly under similar meteorological conditions.

In exploring the Biafo glacier in 1899, we found only one lake on it, a border lake, about 150 feet long, on the right side, three-quarters of a mile above the end of snout. At the upper part, where the Biafo broadens into Snow Lake, we encountered one of the surface sheets of water mentioned, ankle-deep, through which we waded for about 3 miles. Much more water was met with on the Biafo than on the Chogo Lungma, running in streams, some of them large, which cut deep channels into the ice, and finally plunged into caverns or crevasses, to be seen no more.

The Chogo Lungma rises more sharply than the Biafo, and to an altitude 3000 feet higher. Its upper third is much more arctic in character than the Biafo, and melting does not take place to nearly the same degree. Its surface is more broken and fissured, so that there is not the same chance for streams to form. Besides a large central surface lake surrounded by picturesque ice-cliffs, there are a number of lakes scattered over its surface and along its sides and beds of others that have been drained.

While camping on a maidan on the left bank of the glacier, we witnessed the process of emptying of a lake of the variety described as sub-glacial, one side of which was enclosed by a high lateral moraine, above which the glacier towered. The lake was fed by sub-glacial streams, the ice above it being much broken.

Late in the afternoon, when the lake became filled to the upper edge of the moraine, water began to flow over the latter in two small rivulets, which, washing out the finer particles of detritus, soon cut channels for themselves into its substance. These channels gradually increased in width and depth, until at last two good-sized sluices were discharging an ever-increasing amount of water from the reservoir behind, which about midnight became emptied, or, at least, so far reduced in volume that no more water came from it. The discharge was so well graduated that the natural streams below took care of the water without any great increase in volume.

We also had two opportunities to observe the phenomena of the shwas, in one of which (fully described in 'In the Ice World of Himalaya') we saw it burst out from near the end of the snout of a glacier, and, following the windings of a mountain torrent, pursue its devastating course downward for at least a mile, till it swept by us like a whirlwind. As our route took us down the gorge through which it passed, we were able to study its effects.

Interesting points about a shwas, as we saw it, are (1) that it comes in one compact body with irresistible force, sweeping everything movable before it, and ceases nearly as suddenly as it appears, leaving its track torn but free from noticeable deposit of mud or detritus, till its speed is checked in the levels below; (2) its extraordinary mobility. Composed of a vast mass of stones and rocks, some of them many feet in diameter and hundreds of tons in weight, held together by semi-liquid mud, it follows the windings of a torrent bed and turns corners with nearly as much facility as water.

WILLIAM HUNTER WORKMAN.

Paris, May 9, 1905.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904-1905.

Twelfth Meeting, *May* 8, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Walter Amsden, M.R.C.S., L.R.C.P.; Colonel H. G. Proctor Beauchamp, C.B. (late 20th Hussars); Ernest Lionel Bent; Harold John Burkill, M.A.; Arthur E. Farrer; Frederick William Gill; Major Charles W. Gwynn, R.E.; Captain W. Hayes-Sadler (Royal Scots Fusiliers); Ru'iff Stephen Holway; Lieut. Robert Hugh Howell (15th Lancers); Baron Erik Gustaf Evert Leijonhufrud; Adrian Lumley; Wm. Northrup McMillan; H. F. T. Maguire; J. A. Neale, D.C.L.; Lieut. T. M. Potts, R.N.R. (Comm. Egyptian Coastguard Service); Thos. Cameron Tanner.*

The Paper read was:—

"The Nile Provinces and Western Uganda." By Lieut.-Colonel Delmé-Radcliffe, M.V.O.

Thirteenth Meeting, *May* 15, 1905.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Captain W. B. T. Abbey (I.A. Asst.-Commr. Burma Commission); Oscar Henrich Anz; Arthur Henry Chanter; Harry Coleman; John Braidwood Gray; Captain A. F. Fletcher (17th Lancers); George Edw. Luckmann Gauntlett; Stanley Greville Harding; H. Herbert Holloway; Alexander Constantine Ionides; Captain Henry Raleigh Knight (East Kent Regiment); Captain L. C. Jackson, R.E.; John Tinney McCutcheon; Ian Z. Malcolm, M.P.; Archibald Rose; Charles James Cater Scott; James Herbert Smith; Charles J. Taylor; Captain Benjamin Irby Way (North Staffs. Regt.); John R. Williams.*

The Paper read was:—

"Exploration and Survey in Central Tibet and to the Sources of the Brahmaputra." By Major C. H. D. Ryder, R.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Albania. **Patsch.**
K. Akademie der Wissenschaften. Schriften der Balkankommission, Antiquarische Abteilung. III. Das Sandschak Berat in Albanien. Von C. Patsch. Wien: A. Hölder, 1904. Size 12½ × 9½, pp. 200. *Map and Illustrations. Price* 16*s*.

Although his researches were primarily concerned with archæology, the writer paid some attention to the general configuration of the country traversed, the condition of the people, and so forth. The work, therefore, is some addition to our knowledge from these points of view.

Alps. *C. Rd.* **139** (1904): 719–721. **Helbronner.**
Sur les triangulations géodésiques complémentaires des hautes régions des Alpes françaises. Note de P. Helbronner.

Alps. *C. Rd.* **139** (1904): 754–756. **Termier.**
Sur la structure générale des Alpes du Tyrol à l'ouest de la voie ferrée du Brenner. Note de P. Termier.

Alps. *C. Rd.* **139** (1904): 687–690. **Termier.**
Sur la continuité des phénomènes tectoniques entre l'Ortler et les Hohe Tauern. Note de P. Termier.

Austria. *Abh. K.K.G. Ges. Wien* **5** (1903–4) (No. 2): pp. x. and 136. **Gavazzi.**
Die Seen des Karstes. Erster Teil: Morphologisches material gesammelt von Dr. A. Gavazzi. *With Maps and Illustrations.*

Austria. *M.K.K.G. Ges. Wien* **47** (1904): 463–469. **Schaffer.**
Neue Beobachtungen zur Kenntnis der alten Flussterrassen bei Wien von Dr. F. X. Schaffer.

Austria—Bosnia and Herzegovina. **Łoziński.**
M.K.K.G. Ges. Wien **47** (1904): 538–558.
Aus der quartären Vergangenheit Bosniens und der Herzegovina. Von Dr. Walery Ritter von Łoziński. *With Plates.*

Austria—Istria. *Riv. G. Italiana* **12** (1905): 19–29. **Gravisi.**
Distribuzione della popolazione dell' Istria secondo la costituzione geologica del suolo. Studio di G. Gravisi.

Austria—Istria. *Globus* **86** (1904): 297–299. **Schneider.**
Die Entwaldung Istriens. Von K. Schneider.

Belgium and Holland. **Baedeker.**
Belgium and Holland, including the Grand-Duchy of Luxembourg. Handbook for Travellers by Karl Baedeker. 14th edition. Leipzig: K. Baedeker; London: Dulau & Co., 1905. Size 6½ × 4½, pp. lxx. and 474. *Maps and Plans. Price* 6*m*. *Presented by the Publishers.*

Central Europe. *Meteorolog. Z.* **21** (1904): 441–452. **Schreiber.**
Ueber die Beziehungen zwischen dem Niederschlag und der Wasserführung der Flüsse in Mitteleuropa. Von Dr. P. Schreiber.

Denmark—Stone and Bronze Ages. **Müller.**
Mém. S.R. Antiquaires Nord **1** (1903): 60–140.
Routes et lieux habités à l'age de la pierre et à l'age du bronze. Par S. Müller. Traduit par E. Philipot.

Europe—Glacial Epoch. *G.Z.* **10** (1904): 657–665. **Partsch.**
Die Eiszeit in den Gebirgen Europas zwischen dem nordischen und dem alpinen Eisgebiet. Von Prof. Dr. J. Partsch.

Cf. note in the *Journal* for November last, p. 586.

France—Picardy. **Demangeon.**
Albert Demangeon. La Picardie et les régions voisines, Artois—Cambrésis—Beauvaisis. Paris: A. Colin, 1905. Size 10 × 6½, pp. 496. *Maps and Illustrations. Price* 12 *fr. Presented by the Publisher.*

An excellent study in regional geography.

France—Vendée. **Clouzot.**

Étienne Clouzot. Les Marais de la Sèvre Niortaise et du Lay du X^{e} à la fin du XVI^{e} siècle. Paris: H. Champion, 1904. Size 10 × 6½, pp. 284. *Maps. Presented by the Publisher.*

Traces the history of the draining of the marshes to the north of the lower Sèvre Niortaise, and the various vicissitudes to which they have been subject.

Germany. *Globus* **86** (1904): 241–245. **Halbfass.**

Die Tieferlegung des Chiemsees. Ein Kapitel aus der Wirtschaftsgeographie. Von Prof. Dr. W. Halbfass. *Diagrams.*

Germany. *Globus* **86** (1904): 257–259. **Halbfass.**

Der Frickenhäuser See in Unterfranken. Von W. Halbfass. *With Map and Illustration.*

Germany. *Sitzb. K.P.A.W. Berlin,* 1904 (2): 1422–1431. **Hellmann.**

Ueber die relative Regenarmuth der deutschen Flachküsten. Von Dr. G. Hellmann. *With Maps.*

Germany—Brandenburg. **Bache.**

Die Landschaften der Provinz Brandenburg. Von Dr. Edward Bache. (Deutsches Land und Leben in Einzelschilderungen. Landschaftskunden und Stadtegeschichten. I. Landschaftskunden.) Stuttgart: Hobbing und Büchle, 1905. Size 8¾ × 6, pp. viii. and 338. *Maps, Plates, etc. Price 6m. 25pf. Presented by the Publishers.*

The previous volumes of this excellent series have already been noticed in the *Journal* (vol. **23**, p. 505). The present work is arranged on a thoroughly scientific basis, the region dealt with being divided up, for description in detail, according to its physical configuration.

Russia—Ural. **Duparc and Pearce.**

Mém. S. Phys. et d'Hist. Nat. Genève **34** (1905): 383–602.

Recherches géologiques et pétrographiques sur l'Oural du Nord dans la Ratesskaya et Kizelowskaya-Datcha (Gouvernement de Perm), par L. Duparc et F. Pearce. Deuxième Mémoire. *With Map and Illustrations.*

The greater part of the memoir deals with the rocks observed, but the first two chapters give a general sketch of the topography, hydrography, and geology of the Tilaï-Kanjakovski-Serebrianski chain.

Sweden—Anthropogeography. *Ymer* **24** (1904): 281–296. **Stolpe.**

Om sambandet mellan befolknings-fördelning och geologiska bildningar i Sverige. Af P. Stolpe.

On the relation between geological structure and distribution of population in Sweden.

Switzerland. **Früh and Schröter.**

Beiträge zur Geologie der Schweiz herausgegeben von der Geologischen Kommission der Schweiz. Naturforschenden Gesellschaft, Geotechnische Serie, III. Lieferung. Die Moore der Schweiz mit berücksichtigung der gesamten Moorfrage von Prof. Dr. J. Früh und Prof. Dr. C. Schröter. Bern: A. Francke, 1904. Size 12½ × 9½, pp. xviii. and 752. *Maps and Illustrations. Presented by the Publishers.* [To be reviewed.]

Switzerland. *C. Rd.* **139** (1904): 936–938. **Delebecque.**

Sur les lacs du Grimsel et du massif du Saint-Gothard. Note de A. Delebecque.

Switzerland. *Questions Dipl. et Colon.* **18** (1904): 413–431. **Girardin.**

L'ouverture du Simplon et les intérêts français. Par Prof. P. Girardin.

Switzerland. *Vierteljahrs. Naturforsch. Ges. Zürich* **49** (1904): 40–63. **Voskule.**

Untersuchung und Vermessung des in der letzten Rückzugsperiode verlassenen Bodens des Hüfi-Gletchers. Von G. A. Voskule. *With Map and Plates.*

Switzerland. ——

Résultats statistiques du Recensement Fédéral du 1er Décembre, 1900. Premier Volume. Berne, 1904. Size 11 × 9, pp. 48 and 370. *Maps.*

Switzerland—Jura. **Machaček.**

Petermanns M., Ergänzungsheft, Nr. 150 (1905): pp. 148.

Der Schweizer Jura. Versuch einer geomorphologischen Monographie. Von Dr. F. Machaček. *With Map, Profiles, and Illustrations.*

Switzerland—Simplon. *A travers le Monde* 10 (1904): 269–270. **Orsat.**
Autour du Simplon. Par J. Orsat. *With Maps.*

Turkey—Albania. *B.S.G. Italiana* 5 (1904): 689–703. **Barbarich.**
Saggio per una sistemazione orotettonica della regione albanese. Del tenente E. Barbarich. *With Maps.*

United Kingdom. *Symons's Meteorolog. Mag.* 39 (1904): 172–174. **Gethin-Jones.**
The Wettest Spot in the United Kingdom. By J. R. Gethin Jones.

The writer gives reasons for supposing that the maximum rainfall in the Kerry mountains is likely to exceed that of the Stye or Snowdon (cf. *Journal*, vol. 24, p. 474).

United Kingdom—Derbyshire. **Firth.**
Highways and Byways in Derbyshire. By J. B. Firth, with Illustrations by Nelly Erichsen. London: Macmillan & Co., 1905. Size 8 × 5½, pp. xviii. and 500. *Maps and Illustrations. Price* 6s. *Presented by the Publishers.*

Derbyshire supplies, perhaps, as inspiring a theme for a volume of the kind as any part of the British Isles, and the author's treatment does the subject full justice. While the chief attention is avowedly directed to the literary and historical associations of the county, there are at the same time some excellent descriptions of its natural scenery, both main types of which meet with equal appreciation from the author.

United Kingdom—Wales. **Straham and Cantrill.**
Memoirs of the Geological Survey, England and Wales. The Geology of the South Wales Coalfield. Part vi. The Country around Bridgend. Being an Account of the Region comprised in Sheets 261, 262, of the map. By A. Strahan, F.R.S., and T. C. Cantrill, B.SC. London: E. Stanford, 1904. Size 10 × 6, pp. vi. and 120. *Maps and Sections. Price* 1*s.* 6*d.*

ASIA.

Asia. **Gobineau.**
Trois ans en Asie (de 1855 à 1858). Par le Comte A. de Gobineau. Nouvelle édition. Paris: E. Leroux, 1905. Size 10 × 6½, pp. vi. and 500.

Reprint of a work published half a century ago, dealing principally with Persia, to which the author (best known for his other work, entitled 'Religions et philosophies dans l'Asie centrale') went out as French minister. There are chapters on Jiddah and Maskat, which were touched at *en route.*

Asia—History. **Cordier.**
Henri Cordier. Aperçu sur l'Histoire de l'Asie en général et de la Chine en particulier. Paris: E. Guilmoto, [not dated]. Size 9 × 6, pp. 57. *Presented by the Author.*

China. *B.S.G. Italiana* 5 (1904): 826–849. **Chiminelli.**
Pechino e la Città Proibita. Conferenza dal cav. E. Chiminelli.

China. *National G. Mag.* 15 (1904): 463–478. **Foster.**
China. By Hon. J. W. Foster. *With Maps.*

French Indo-China—Tonkin. *C. Rd.* 139 (1904): 1081–1081. ———
Prix Tchihatchef.

This award has been given to Colonel Lubanski for the excellent surveys inaugurated by him in Tongking.

Palestine—Galilee. **Schwöbel.**
Die Verkehrswege und Ansiedlungen Galiläas in ihrer Abhängigkeit von den natürlichen Bedingungen. Von Dr. V. Schwöbel. (Separatdruck aus der Z. Deut. Palästina-Vereins, Bd. xxviii.) Leipzig, 1904. Size 9 × 6, pp. 152. *Map.*

Reviewed at p. 316, *ante.*

Pamirs. *G. Tidskrift* 17 (1903–1904): 241–258. **Olufsen.**
Pamir. Alaisteppen, den afløbsløse Sø Kara Kul i det øde Ørken-Pamir og Ruten over Bjærgene mod Syd til Murgab floden. Af O. Olufsen. *Map and Illustrations.*

Persia. *Petermanns M.* 50 (1904): 227–235. **Stahl.**
Die orographischen und geologischen Verhältnisse des Karadag in Persien. Von A. F. Stahl. *With Map.*

Persia. **Malcolm.**
Five Years in a Persian Town. By N. Malcolm. London: John Murray, 1905. Size 8½ × 6, pp. xiv. and 272. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

The town referred to in the title is Yezd, in which the writer has worked as a missionary. The book deals particularly with the circumstances under which missionaries work in Persia, and is noteworthy for the care which is taken to bring out the character of the people as influenced by external physical factors.

Persian Gulf. *B.R.S.G. Madrid* **46** (1904): 164–175. **Pedro.**
Estudio sobre el Golfo Pérsico. Por Fr. Pedro de la Madre de Dios.

Philippine Islands. **Blair and Robertson.**
The Philippine Islands, 1493–1898. Edited and annotated by E. H. Blair and J. A. Robertson, with historical introduction and additional notes by E. G. Bourne. Vol. **16**, 1609 (pp. 330); vol. **17**, 1609–1616 (pp. 336); vol. **18**, 1617–1620 (pp. 346); vol. **19**, 1620–1621 (pp. 320); vol. **20**, 1621–1624 (pp. 306). Cleveland, Ohio: The Arthur H. Clark Co., 1904. Size 10 × 6½. *Plates.*

Philippine Islands. ———
Louisiana Purchase Exposition. St. Louis, 1904. Official Handbook of the Philippines and Catalogue of the Philippine Exhibit. Part i. Manila, 1903. Size 9¼ × 6, pp. 450. *Illustrations.*

Russia—Caucasus. **Stevens.**
Cultivation of Tea in the Caucasus. Foreign Office, Miscellaneous No. 628, 1905. Size 9½ × 6½, pp. 6. *Price* ½*d.*

Russia—Kamchatka. **Bogdanowitsch.**
Petermanns M. **50** (1904): 59–68, 96–100, 122–125, 144–148, 170–174, 196–199, 217–221.
Geologische Skizze von Kamtschatka. Von K. Bogdanowitch. *With Maps.*

Russia—Siberia. **Bogoras.**
The Jesup North Pacific Expedition. Memoir of the American Museum of Natural History, New York. Vol. 7. The Chukchee. By W. Bogoras. I. Material Culture. Leiden: E. J. Brill, 1904. Size 14½ × 11½, pp. 276. *Maps and Illustrations. Price* 34*s. net.*

The results of this expedition are to be published in an extensive series of volumes, the completion of which will be a matter of some time.

Russia—Siberia. *Petermanns M.* **50** (1904): 222-224. **Sibiriakoff.**
Von Beresow zu Schiff zur Mündung des Tas. Von A. Sibiriakoff.

Russia—Siberia. *Iz. Imp. Russ. G.S.* **40** (1904): 31-130. **Dinin-Garkavitch.**
Sketch of the Population in the North-Tobolsk Province. By A. A. Dinin-Garkavitch. [In Russian.]
Geographical Sketch of the North-Tobolsk Province. By the same. [In Russian.] *With Map.*

Russia—Siberia. *Tour du Monde* **10** (1904): 313–372. **Stadling.**
A travers la Sibérie à la recherche d'Andrée. Par J. Stadling. Traduit et résumé par M. de Broche des Combes. *With Map and Illustrations.*

Mr. Stadling brought out an account of his journey in English in 1904 (*Journal*, vol. 17, p. 674).

Russia—Siberia. *Smithsonian Rep.*, 1903 (1904): 611–625. **Herz.**
Frozen Mammoth in Siberia. By O. F. Herz. *Illustrations.*

Extracts translated from the report (in Russian) published in the *Bulletin* of the St. Petersburg Academy for 1902.

Russia—Siberia. **Meister.**
Explorations géologiques dans les régions aurifères de la Sibérie. Carte géologique de la région aurifère d'Iénisséi. Description de la feuille K-7, A. Meister (pp. viii. and 62); Ditto, K-8 (pp. 90); Ditto, L-6 (pp. 36); Ditto, L-8 (pp. 70); Ditto, L-9 (pp. 48). [In Russian.] St. Petersburg, 1903–1904. Size 10 × 6½.

Russian Central Asia. *Iz. Imp. Russ. G.S.* **40** (1904): 1–30. **Novitsky.**
Journey in the Peter the Great Range in the Summer of 1903. By V. F. Novitsky. [In Russian.]

Siam. **Carter.**
The Kingdom of Siam. Ministry of Agriculture, Louisiana Purchase Exposition, St. Louis, U.S.A., 1904. Siamese Section. Edited by A. Cecil Carter, M.A. New York and London: G. P. Putnam's Sons, 1904. Size $7\frac{1}{2} \times 5$, pp. xii. and 280. *Illustrations.*

Turkey—Asia Minor. *Asien* 3 (1904): 148–151. **Simmersbach.**
Das Steinkohlenbecken von Heraclea in Kleinasien. Von B. Simmersbach.

Turkey—Asia Minor. *Z. Ges. Erdk. Berlin* (1904): 407–425, 498–521. **Janke.**
Die Ergebnisse einer historisch-geographischen Studienreise in Klein-Asien im Jahr 1902. Von A. Janke. *With Maps and Plates.*

Turkey—Asia Minor. *A travers le Monde* 10 (1904): 385–388. **Armagnac.**
Une Ascension au mont Olympe de Bithynie. Par J. Armagnac. *Illustrations.*

Turkey—Mesopotamia. *Asien* 4 (1904): 6–9. **Wiedemann.**
Die Kurden in Nord-Mesopotamien. Von Dr. M. Wiedemann.

Turkey—Palestine. *B. American G.S.* 36 (1904): 577–589. **Cady.**
The Historical and Physical Geography of the Dead Sea Region. By the Rev. P. Cady.

Turkey—Palestine. *Geolog. Mag.* 1 (1904): 575–582. **Bonney.**
The Kishon and Jordan Valleys. By Prof. T. G. Bonney, D.SC., etc. *With Map.*
Noticed in the Monthly Record for April (p. 454).

Turkey—Palestine. **Macalister and Masterman.**
Palestine Exploration Fund, Q. Statement (1904): 150–160; (1905): 48–61.
Occasional Papers on the Modern Inhabitants of Palestine. By R. A. S. Macalister and E. W. G. Masterman.

AFRICA.

Algeria. *C. Rd.* 140 (1905): 155–157. **Savornin.**
Esquisse orogénique des Chaînons de l'Atlas au nord-ouest du Chott el Hodna. Note de — Savornin.

Algeria—Oran. *A travers le Monde* 10 (1904): 417–420. **Myrica.**
Le Port d'Oran. Son Développement rapide et son brilliant Avenir. Par P. de Myrica. *Illustrations.*

Azores. *Archiv. Açores* 13 (1904): 53–60. **Chaves.**
Erupções submarinas nos Açores e a quebra de alguns dos cabos telegraphicos lançados nos mares do mesmo archipelago. F. A. Chaves.

Azores. *Archiv. Açores* 13 (1904): 61–70. **Chaves.**
Os Açores num atlas manuscrito feito em Veneza no seculo XV. F. A. Chaves. *With facsimile Maps.*

The manuscript atlas referred to is now in the Egerton collection in the British Museum (No. 73), and includes charts by various draughtsmen.

Cape Colony. **Gordon.**
Cape of Good Hope. Report by the Director of Irrigation on his Tour through the North-Western Districts. June–July, 1904. Cape Town, 1904. Size $13 \times 8\frac{1}{2}$, pp. 28. *Maps and Plans.*

Central Africa—Lake Kivu. *Globus* 86 (1904): 209–114, 245–249. **Kandt.**
Ein Marsch am Ostufer des Kiwu. Von Dr. R. Kandt. *Illustrations.*

Comoro Islands. *Rev. Maritime* 163 (1904): 5–18. **Gloaguen.**
Notes sur les Comores. Par — Gloaguen.

Congo State—Katanga. *Mouvement G.* 21 (1904): 553–559. ———
Au Katanga. *With Map.*
A sketch of the operations of the Katanga Company.

Egypt. **Seton-Karr.**
Fayoom Flint Implements. By H. W. Seton-Karr. Size $11 \times 7\frac{1}{2}$, pp. 42. *Illustrations. Presented by the Author.*
See note in the Monthly Record for April (p. 457).

Egypt. *Geolog. Mag.* 2 (1905): 58–62. **Barron.**
On the Age of the Gebel Ahmar Sands and Sandstone, the Petrified Forest, and the Associated Lavas between Cairo and Suez. By T. Barron.

Egypt—Sinai. *B.S. Khédiv. G.* 6 (1904): 243-280. **Clifton.**
Une excursion au Sinai. Par C. Clifton.

French Chad Territories. **Fourneau.**
Renseign. Colon., Comité l'Afrique Française (1904): 121–125, 145–152.
Deux années dans la région du Tchad. Par A. Fourneau. *With Map.*

French Congo. *C. Rd.* 140 (1905): 160-162. **Courtet.**
Observations géologiques recueillies par la mission Chari—Lac Tchad. Note de H. Courtet.

German East Africa. *Z. Ges. Erdk. Berlin* (1904): 627–650, 692–718. **Uhlig.**
Vom Kilimandscharo zum Meru. Vorläufige Mitteilungen über eine Forschungsreise. Von Prof. Dr. C. Uhlig. *With Map and Illustrations.*
See note in the Monthly Record for February (p. 213).

Kamerun—Climate. *Meteorolog. Z.* 21 (1904): 537-547. **Plehn, Hutter, and Hann.**
Das Klima von Kamerun. Beschreibung desselben nach Dr. Plehn, und Hauptmann Hutter. Klimatabellen von J. Hann.

Nigeria. **Lugard.**
Northern Nigeria. Report for 1903. Colonial Reports, Annual No. 437, 1904. Size 9½ × 6, pp. 42. *Diagram. Price* 4*d.*

Orange River Colony. *T. Geolog. S. South Africa* 7 (1904): 115–116. **Molengraaff.**
The Vredefort Mountain-land. By G. A. F. Molengraaff.

Portuguese East Africa. *B.S. Neuchateloise G.* 15 (1904): 5–31. **Berthoud.**
Deux problèmes hydrographiques du Pays de Gaza. Par H. Berthoud. *With Map.*

Portuguese East Africa. *B.S. Neuchateloise G.* 15 (1904): 81–83. **Grandjean.**
Quelques notes sur la zone qui s'étend entre le Bas Nkomati et la mer (Province de Lourenço Marques). Par A. Grandjean. *Map.*

Sahara. *La G., B.S.G. Paris* 10 (1904): 1–18, 85-102. **Gautier.**
Le Mouidir-Ahnet. Essai de géographie physique d'après des observations faites au cours du raid effectué par le commandant Laperrine (printemps 1903). Par E. F. Gautier. *Map.*

Sahara. *Renseign. Col. Com. Afrique Franç.* (1904): 205-213, 243-251. **Voinot.**
A travers le Mouydir, Rapport de tournée du lieutenant Voinot. Avril à Août, 1903. *Map and Illustrations.*

Sudan. *C. Rd.* 139 (1904): 1186-1190. **Lapparent.**
Sur de nouvelles trouvailles géologiques au Soudan. Note de A. de Lapparent.

Sudan. **Ward.**
Our Sudan, its Pyramids and Progress. By John Ward. London: John Murray, 1905. Size 10½ × 8, pp. xxiv. and 362. *Map and Illustrations. Price* 21*s. net. Presented by the Publisher.*

Somewhat miscellaneous jottings, in which notes on the archæology and recent history of the Nilotic Sudan are brought together without much system. There are a large number of illustrations of people, places, and incidents taken from various sources, but many are decidedly second-rate.

Transvaal. **Hatch and Corstorphine.**
The Geology of the Bezuidenhout Valley and the District East of Johannesburg. By F. H. Hatch and G. S. Corstorphine. (From *T. Geol. S. South Africa*, vol. 6, Part ii., 1904.) Size 9½ × 7½, pp. 97-109. *Sections and Illustrations. Presented by the Authors.*

Tripoli—Ghat. **Lippert.**
M. Seminars Orient. Sprachen 7 (1904) (*Afrikan. Studien*): 86–93.
Zur Eroberung der Stadt Ghat durch die Türken. Von J. Lippert.

Tripoli—Trade. **Medana.**
Il Vilayet di Tripoli di Barberia nell' anno 1902. Relazione del cav. A. Medana. (R. Ministero Affari Esteri. Nov. 1904.) Roma, 1904. Size 9 × 6½, pp. 154.

Tristan da Cunha. ——
Tristan da Cunha. Further Correspondence relating to the Island of Tristan da Cunha. (In continuation of [C. 8357] February, 1897.) London: Eyre & Spottiswoode, 1903. Size 13 × 8½, pp. iv. and 20. *Chart. Price 4d.*

Tristan da Cunha. *South Africa* **63** (1904): 940; **64** (1904): 41–42. ——
The Island of Tristan d'Acunha. *With Illustrations.*

Tunis—Kerkenna Islands. *La G., B.S.G. Paris* **10** (1904): 201–222. **Allemand-Martin.**
Les îles Kerkenna. Essai de Colonisation agricole. Par A. Allemand-Martin. *With Maps and Illustrations.*

Uganda. *Climate* **5** (1904): 114–119. **Cook.**
The Climate of Uganda. With a few notes upon its commoner diseases. By J. H. Cook. *With Map and Illustrations.*

Uganda. *Church Miss. Intelligencer* **55** (1904): 815–820. **Kitching and Lloyd.**
The Acholi Country. By the Rev. A. L. Kitching and A. B. Lloyd. *With Illustration.*

The Acholi are one of the less-known tribes on the upper Nile.

West Africa. **Lenfant.**
Commandant Lenfant. La grande route du Tchad. Mission de la Société de Géographie. Préface par M. Le Myre de Vilers. Introduction de Maurice Albert. Paris: Hachette et Cie., 1905 [1904]. Size 10 × 6½, pp. xvi. and 288. *Map and Illustrations. Price* 12 *fr. Presented by the Publishers.* [To be reviewed.]

West Africa. *K.A.W. Amsterdam, P. Sec. Sci.* **6** (1904): 426–440. **Sanders.**
Contributions to the determination of geographical positions on the West Coast of Africa (II.). By C. Sanders. I. Determination of the longitude of Chiloango made in the years 1901 and 1902. II. Determination of the geographical position of Mayili.

After elaborate corrections, the result arrived at for the harbour light at Chiloango is −48m. 32·1s. ± 1s.

West Africa. *Deutsch. Kolonialblatt* **15** (1904): 580–581. ——
Grenzfestsetzung zwischen dem deutschen Schutzgebiet Togo und den Northern Territories der englischen Goldküsten-Kolonie vom Schnittpunkt des Dakaflusses mit dem 9. Grad nördl. Br. nordwärts bis zur Südgrenze des französischen Sudan.

West Africa—Railways. ——
West Africa. Papers relating to the Construction of Railways in Sierra Leone, Lagos, and the Gold Coast. London: Eyre & Spottiswoode, 1904. Size 13 × 8½, pp. 40. *Maps and Diagrams. Price* 2*s.*

West Africa—Rubber. ——
Reports on Rubber in the Gold Coast and Sierra Leone. Colonial Reports, Miscellaneous, No. 28, 1904. Size 10 × 6½, pp. 20. *Illustration. Price* 1½*d.*

NORTH AMERICA.

Alaska. *Abstract P. Linnean S. New York* (1903–1904): 15–39. **Figgins.**
Field Notes on the Birds and Mammals of the Cook's Inlet Region of Alaska. By J. D. Figgins. *Illustrations.*

Includes some notes on the country traversed by the writer.

Canada—Labrador. *Period. Accounts Moravian Missions* **5** (1904): 608–622. ——
Labrador. Extracts from the Station Diaries, July 1, 1903—July 1, 1904. *With Illustrations.*

Mexico. *M.K.K.G. Ges. Wien* **47** (1904): 421–462. **Schmit.**
Mein erster Ausflug in die mexikanische Tierra caliente. Erinnerungen aus dem Jahre 1865. Von Dr. E. Schmit Ritter von Tavera.

North America. **Chittenden and Richardson.**
Life, Letters, and Travels of Father Pierre-Jean de Smet, S.J., 1801–1873. Missionary Labours and Adventures among the Wild Tribes of the North American Indians, embracing minute description of their Manners, Customs, Games, Modes

of Warfare and Torture, Legends, Tradition, etc., all from Personal Observations made during many thousand miles of Travel, with Sketches of the Country from St. Louis to Puget sound and the Altrabasca. Edited from the original unpublished manuscript Journals and Letter Books and from his Printed Works, with Historical, Geographical, Ethnological, and other Notes; also a Life of Father De Smet. By H. M. Chittenden and A. T. Richardson. Four Volumes. New York: F. P. Harper, 1905. Size 10 × 6½, pp. xiv. and 1624. *Maps and Illustrations. Price 63s. net.*

United States—Black Hills. **Irving, Emmons, and Jaggar.**
U. S. Geolog. Surv., Profess. Paper, No. **26** (1904): pp. 222.
Economic Resources of the Northern Black Hills. By J. D. Irving, with contributions by S. F. Emmons and T. A. Jaggar, jun. *With Maps and Plates.*

The resources dealt with are entirely mineral. The first part gives a general sketch of the geology of the district.

United States—California. *J. Geology* **12** (1904): 579-588. **Gilbert.**
Systematic Asymetry of Crest Lines in the High Sierra of California. By G. K. Gilbert. *With Illustrations.*

United States—California. *Sierra Club B.* **5** (1905): 229-237. **Le Conte.**
The Evolution Group of Peaks. By J. N. Le Conte. *With Map and Illustrations.*

United States—Colorado. *Appalachia* **10** (1904): 392-404. **Davis.**
Glacial Erosion in the Sawatch Range, Colorado. By Prof. W. M. Davis.
Noticed in the Monthly Record for March (p. 328).

United States—Early Travels. **Thwaites.**
Early Western Travels, 1748-1846. Edited . . . by R. G. Thwaites, LL.D. Vol. vi., Brackenridge's Journal up the Missouri, 1811; Franchère's Voyage to North-west Coast, 1811-1814 (pp. 410); vol. vii., Ross's Adventures of the First Settlers on the Oregon or Columbia River, 1810-1813 (pp. 332); vol. viii., Buttrick's Voyages, 1812-1819; Evans's Pedestrious Tour, 1818 (pp. 364); Vol. ix., Flint's Letters from America, 1818-1820 (pp. 334); vol. x., Hulme's Journal, 1818-19; Flower's Letters from Lexington and the Illinois, 1819; Flower's Letters from the Illinois, 1820-21; Woods's Two Years' Residence, 1820-21 (pp. 358); vol. xi., Part i. (1819) of Faux's Memorable Days in America, 1819-20 (pp. 306); vol. xii., Part ii. (1820) of the same; Welby's Visit to North America, 1819-20. Cleveland, Ohio: The Arthur H. Clark Co., 1904-5. Size 9½ × 6½. *Maps and Plates.*

United States—Geological Survey. *National G. Mag.* **15** (1904): 365-366. ———
What the U.S. Geological Survey has done in Twenty-five years.

United States—Immigration. *Popular Sci. Monthly* **66** (1904): 166-175. **Ward.**
The Agricultural Distribution of Immigrants. By R. De C. Ward.

United States—Indiana. **Dryer.**
Studies in Indiana Geography. Edited by Prof. C. R. Dryer. First Series. Revised Edition. Terre Haute, Ind.: the Inland Publishing Co., 1905. Size 11 × 8, pp. 114. *Maps. Presented by the Author.*

An excellent series of studies in local geography, intended as a step towards supplying the need, lately emphasized by Prof. W. M. Davis, of a better knowledge, on the part of teachers, of the geography of their own country.

United States—Maryland. **Steiner.**
Descriptions of Maryland. By B. C. Steiner. (Johns Hopkins University Studies. Series xxii., Nos. 11-12.) Baltimore: 1904. Size 9½ × 6½, pp. 94.

Opens with a historical sketch, the latter, and larger, part of the work consisting of a bibliography.

United States—Meteorology. *Monthly Weather Rev.* **32** (1904): 358-363. **Hanzlik.**
The Annual and Geographical Distribution of Cyclones of high velocity (over 500 miles in twelve hours) in the United States, 1893-1902. By Dr. S. Hanzlik. *Diagrams.*

United States—Montana and Idaho. **Lindgren.**
U.S. Geolog. Survey, Profess. Paper No. 27 (1904): pp. 124.
A Geological Reconnaissance across the Bitter-root Range and Clearwater Mountains in Montana and Idaho. By W. Lindgren. *With Maps and Plates.*

United States—New York. **Tarr.**
Hanging Valleys in the Finger Lake Region of Central New York. By R. S. Tarr. [From the *American Geologist*, vol. 33, May, 1904, pp. 271–291.] Size 9½ × 6½. *Map and Plates. Presented by the Author.*
Noticed in the Monthly Record (February number, p. 215).

United States—Pennsylvania. *J. Geology* 12 (1904): 473–484. **Stose.**
Physiographic Studies in Southern Pennsylvania. By G. W. Stose. *With Map and Illustrations.*

United States—Survey. *B. American G.S.* 36 (1904): 676–679. ——
Work on the U.S. Topographic Atlas.

United States—Utah. *National G. Mag.* 15 (1904): 367–369. ——
Colossal Natural Bridges of Utah. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Census. ——
Censo de la Población de Bolivia. Septiembre 1° de 1900. Tomo ii. La Paz, 1904. Size 14 × 9½, pp. lxxxiv., 48, and 144. *Diagrams.*

Brazil. *Export* 26 (1904): 473–475, 488–489, 501–503. ——
Die Kolonisation in Südbrasilien. (Originalbericht aus Pelotas.)

Brazil. *Globus* 86 (1904): 289-296, 309-315. **Meerwarth.**
Eine zoologische Forschungsreise nach dem Rio Acará im Staate Pará (Brasilien). Von H. Meerwarth. *With Map and Illustrations.*

Dutch Guiana. *Tijds. K. Ned. Aard. Genoots. Amsterdam* 22 (1905): 194–197. ——
Tapanahoni-expeditie.

Dutch Guiana. **Herderschee.**
Tijds. K. Ned. Aard. Genoots. Amsterdam 22 (1905): 1–174.
Verslag van de Gonini-expeditie. Door A. F. Herderschee. *With Map and Illustrations.*

French Guiana. *A travers le Monde* 11 (1905): 13–15. **Deydier.**
Montjoly. Création d'un Centre de Colonisation martiniquaise à la Guyane. Par J. Deydier. *Illustrations.*

Jamaica. **Ford and Finlay.**
The Handbook of Jamaica for 1905. Compiled by J. C. Ford and A. A. C. Finlay. London: E. Stanford, 1905. Size 8½ × 6½, pp. viii. 554, and x. *Map. Price* 7*s.* 6*d.* *Presented by the Publisher.*

AUSTRALASIA AND PACIFIC ISLANDS.

Fiji Islands—Folk Tales. **Fison.**
Tales from Old Fiji. By Lorimer Fison. London: A. Moring, 1904. Size 10 × 6½, pp. xlv. and 175. *Map and Plates. Price 7s. 6d. net. Presented by the Publisher.*
See review in the April number (p. 451).

New Guinea—Dutch. ——
Tijds. K. Ned. Aard. Genoots. Amsterdam 22 (1905): 189-194.
Aanteekeningen omtrent de afdeeling West-Nieuw-Guinea, ontleend aan officieele verslagen. *With Maps.*

New South Wales. *Records Geol. Surv. New South Wales* 7 (1904): 281–300. **Andrews.**
The Geology of the New England Plateau, with special reference to the Granites of Northern New England. Part i. Physiography. By E. C. Andrews. *With Plates.*

Pacific Ocean. *National G. Mag.* 15 (1904): 478–489. **Hague.**
A Doubtful Island of the Pacific. By J. D. Hague. *With Maps and Illustration.*
Noticed in the Monthly Record for March (p. 331).

POLAR REGIONS.

Antarctic. **Davis.**
A Letter from the Antarctic. By Captain J. E. Davis. London: W. Clowes &

Sons, 1901. Size 8½ × 5½, pp. 38. *Portrait and Illustrations. Presented by P. L. H. Davies, Esq.*

The writer was second master of the *Erebus* in Sir James Ross's expedition, and this letter, dated April 11, 1842, gives a vivid description of the voyage.

Antarctic. *Riv. G. Italiana* 12 (1905): 44–45. **Musoni.**

"Terra di Ross" o "Terra di Re Edoardo VII.?" F. Musoni.

Urges priority for the name Rossland.

Antarctic—Scottish Expedition. *Scottish G. Mag.* 21 (1905): 24–37. **Pirie and Brown.**

The Scottish National Antarctic Expedition. Second Antarctic Voyage of the *Scotia.* By J. H. Harvey Pirie and R. N. Rudmose Brown. *With Map, Portrait, and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Cartography—Methods. *M.K.K.G. Ges. Wien* 47 (1904): 280–325, 365–420. **Peucker.**

Neue Beiträge zur Systematik der Geotechnologie. Ein Rundblick über die Reliefs und Wandkarten der Wiener Ausstellung neuerer Lehr- und Anschauungsmittel (1903). Von Dr. K. Peucker.

Compass. *Riv. G. Italiana* 11 (1904): 433–452. **Bertelli.**

Sopra un nuovo supposto primo inventore della bussola nautica. Memoria del Padre T. Bertelli.

Cf. note in Monthly Record for March (p. 334).

Geodesy. *Science* 21 (1905): 46–50. **Tittmann.**

The Present State of Geodesy. By O. H. Tittmann.

Geophysics. *C. Rd.* 140 (1905): 192–198. **Lœwy and Puiseux.**

Étude des photographies lunaires. Considérations sur la marche de la solidification dans l'intérieur d'une planète. Note de MM. Lœwy et Puiseux.

The authors' observations have an important bearing on the past history of the globe.

Nautical Almanac. ———

The Nautical Almanac and Astronomical Ephemeris for the year 1908. Edinburgh, [1905]. Size 9½ × 6, pp. xiv., 602, and 42. *Diagrams. Price* 2*s.* 6*d.* (Also part i. separately. *Price* 1*s.*)

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. **Branner.**

Syllabus of a Course of Lectures on Elementary Geology. By J. C. Branner, PH.D. Second Edition. Stanford University, 1902. Size 9½ × 6, pp. 370. *Illustrations. Presented by the Author.*

Geology. *C. Rd.* 139 (1904): 714–716. **Suess.**

Sur la nature des charriages. Note de E. Suess.

Geomorphology. **Costa.**

Ensaios de Paleogeographia, Evolução geographica das fórmas actuaes. Por A. A. d'Oliveira Machado e Costa. Lisboa, 1904. Size 10½ × 6½, pp. 152. *Maps. Presented by the Author.*

Glacial Erosion. *J. Geology* 12 (1904): 569–578. **Johnson.**

The Profile of Maturity in Alpine Glacial Erosion. By W. D. Johnson.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Kirchhoff.**

Mensch und Erde. Skizzen von den Wechselbeziehungen zwischen beiden. Von Alfred Kirchhoff. Zweite Auflage. Leipzig: B. G. Teubner, 1905. Size 7½ × 5, pp. 128. *Price* 1*m. Presented by the Author.*

A series of striking sketches illustrating the mutual relations between man and his environment. The first edition appeared in 1901.

Anthropology. *Riv. G. Italiana* 11 (1904): 462–472. **Biasutti.**

Problemi vecchi e idee nuove: la classificazione delle razze umane. R. Biasutti.

Historical. **Detlefsen.**

Die geographischen Bücher (II. 242—VI. Schluss) der Naturalis Historia des

Manchuria. **Japan Times.**

The *Japan Times* War Map No. 3. Seat of Battle of Mukden. **Scale 1 : 400,000** or 6·3 stat. miles to an inch. Supplement to the *Japan Times*, **March 16, 1905.** Tokyo. *Presented by Captain J. M. James.*

AFRICA.

Africa. **Service Géographique de l'Armée, Paris.**

Carte de l'Afrique, dressée et exécutée au Service géographique par M. le Commandant de Lannoy de Bissy, de 1882 à 1890, continuée et revisée par M. le Capitaine Rouby. Sheets (new editions): 4, Fez; 16, St. Louis. **Paris: Service** Géographique de l'Armée, 1904–5. *Price* 1.0 *fr. each sheet.*

A remarkable improvement has taken place in the style of production of this map since the first edition was published. The sheets are now clearly printed in colours instead of being in black only, and much new information has been added. It was, doubtless, a mistake to adopt the orthographic projection for the map, and on no sheets of the map is this more apparent than on the present. Owing to their occupying an outlying position on the western limit of the map, the defects of the projection are most conspicuous.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff, War Office. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Lagos, 73-B, 73-F; Southern Nigeria, 74-I, 74-M. London: Topographical Section, General Staff, War Office, 1905. *Price* 1*s*. 6*d*. *each sheet. Presented by the Director of Military Operations.*

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Standard Topographical Map of Canada. Scale 1 : 250,000 or **3·9 stat. miles to** an inch. Sheet 1-S.E., Ontario, London Sheet. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

At the Geographical Congress held in London in 1895 it was decided to adopt the 1 : 1,000,000 natural scale as a standard, and, as far as possible, to construct all future important maps on some even multiple of this scale—such as 1 : 500,000, 1 : 250,000, etc. During the period that has elapsed since that date considerable progress has been made with this scheme, although the ideal 1 : 1,000,000 map of the whole world then suggested is, of course, a thing of the distant future. It is gratifying to see that Canada has now fallen in line with the proposal, and has commenced a general topographical map on the scale of 1 : 250,000—a map which, from the two sheets already received, the first of which was mentioned in this *Journal* in October last, promises to be a really useful and well-executed map. Each sheet is to comprise a degree of latitude and a degree and a half of longitude, and the present one extends from 42° N. to 43° N., and from 80° W. to 81° 30′ W., and includes a part of the northern shores of L. Ontario, and the towns of London, Stratford, Brantford, and Galt.

Canada. **Dept. of the Interior, Ottawa.**

Relief Map of the Dominion of Canada. Scale 1 : 6,336,000 or 100 stat. miles to an inch. Ottawa: Department of the Interior, 1904. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

This is a very creditable attempt at an orographically coloured map of the Dominion of Canada, although at the present time the data for the completion of such a map must be extremely approximate in many districts, especially in the far north. Elevations below 100 feet are left uncoloured, and higher than this the land between 100 feet and over 10,000 feet is shown in six tints of burnt sienna and brown, which have been selected with care, and give a satisfactory and graphic impression of the general relief of the country.

Canada, Northern. **Dept. of the Interior, Ottawa.**

Explorations in Northern Canada and adjacent portions of Greenland and Alaska. Ottawa: Department of the Interior, 1904. *Presented by James White, Esq., Geographer, Department of the Interior, Ottawa.*

This is a most interesting exploration chart of the Arctic Regions of America, showing the routes and dates of the principal expeditions from the earliest times, with the coast-line explored by each in different colours, a full explanation of which is

given. There are one or two slight errors in names, such as "Axel Heiperg" island for Axel Heiberg island, "Ommaney" for Ommanney, the name of the late well-known admiral of that name of Arctic fame; but these are trifling matters, after all, and the chart will be most useful for reference in connection with the history of discovery in these regions.

AUSTRALASIA.

Tasmania. **Surveyor-General, Tasmania.**

Tasmania. Scale 1 : 950,400 or 15 stat. miles to an inch. Hobart: Surveyor-General's Office, 1904. *Presented by the Agent-General for Tasmania.*

Western Australia. **Dept. of Lands and Surveys.**

Map of Western Australia. Scale 1 : 4,742,000 or 75 stat. miles to an inch. Perth: Department of Lands and Surveys, 1903. *Presented by the Agent-General for Western Australia.*

POLAR REGIONS.

Greenland. **Engell.**

Die Verbreitung der rezenten Meeresablagerungen an den Küsten der Disko-Bai, West Grönland. Von M. C. Engell. Scale 1 : 500,000 or 7·9 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafel 8. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

GENERAL.

World. **Johnston.**

The Royal Atlas of Modern Geography. By the late Alexander Keith Johnston, with additions and corrections to present date by G. H. Johnston. Revised sheets: Frontispiece, North Polar Chart; No. 10, France; 11, Spain and Portugal; 16, Belgium and the Netherlands; 17, Denmark; 18, Empire of Germany; 22, Turkey in Europe; 23, Greece; 24, Sweden and Norway; 25, Basin of the Baltic Sea; 29, Central Asia; 31, Palestine; 33 and 34, India; 37, Australia; 40, Africa; 46, North America; 47, Central Canada; 55 and 56, South America. Edinburgh and London: W. & A. K. Johnston, 1905. *Presented by the Publisher.*

Since the notice of the 1905 edition of the Royal Atlas was published in the last number of the *Geographical Journal*, Messrs. W. & A. K. Johnston have forwarded the above revised sheets of the atlas, upon which many of the errors pointed out have been corrected. It is a pity that these sheets were not included in the atlas instead of those so much behind the times.

World. **Petrie and Schokalsky.**

Marck's Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Parts 11 and 12. St. Petersburg: A. F. Marcks, 1905. *Presented by the Publisher.*

These are the concluding parts of this atlas, and contain, besides the title-page and a complete index, the following maps: No. 14, general map of European Russia, on the scale of 1 : 8,250,000; No. 29, European Russia, on the scale of 1 : 2,000,000, sheet 15 bis; Nos. 46 and 47, Siberia, on the scale of 1 : 10,000,000; No. 57, North America, on the scale of 1 : 20,000,000; No. 58, United States, on the scale of 1 : 10,000,000; No. 60, South America, on the scale of 1 : 16,000,000.

The atlas, the first parts of which were noticed in the *Geographical Journal* for February, 1904, has quite answered to expectations, and the style in which it has been produced reflects credit on all concerned.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich, herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha, 45 und 46 Lieferung. These parts contain the following maps: No. 1, The Northern Constellations, by Dr. C. Rohrbach; No. 2, The Southern Constellations, by Dr. C. Rohrbach; Nos. 96 and 98, South America, on the scale of 1 : 7,500,000, by H. Habenicht, sheets 2 and 4. Gotha: Justus Perthes, 1905. *Price 60 pfg. each part.*

The star maps are entirely new productions. In addition to the names of the constellations, Dr. Rohrbach has, for the zodiac, unnecessarily confused his maps with large outline drawings of figures which, on recent maps, have been very properly dispensed with. The system adopted for representing the different magnitudes of the stars is also remarkable, for whilst a 5th magnitude is shown by an extremely small spot about the size of a pinhole, the larger stars are shown as large black discs,

Sirius being nearly as large as a threepenny-piece. This, on a map of the heavens which measures only 13½ × 16 inches, is decidedly misleading, and renders it almost impossible to recognize the general configuration of any constellation or group as a whole.

New stars, nebulæ, variables, and double stars are all distinguished by different symbols, either in black or red, and several telescopic stars are shown in the latter colour.

CHARTS.

Danish Chart. **Danish Admiralty.**

No. 208, Færöerne. Scale 1 : 100,000 or 1·6 stat. mile to an inch. 2 sheets. Copenhagen: Danish Admiralty, 1905. *Presented by the Danish Admiralty.*

Elbe River. **Bureau f. Strom-u. Hafenbau, Hamburg.**

Stromkarte der Norder-Elbe. Scales 1 : 6000 and 1 : 3000 or 10·6 inches and 21·1 inches to 1 stat. mile. Sheets 5, 6, 7, 7A, 10. Hamburg: Bureau für Strom- und Hafenbau, 1904.

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for May, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for May, 1905. London: Meteorological Office, 1905. *Price* 6*d*. *Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for May, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

Norway. **Norges Geografiske Opmaaling.**

Norwegian Hydrographic Charts, Nos.: A 4, Den Norske Kyst fra Leka og Sklinden til Vestfjorden, scale 1 : 350,000, 2 sheets, 1904; A 131, Specialkart over Nordfjord, scale 1 : 100,000, 1903, *price kr.* 1·60; B 441, Specialkart over den Norske Kyst fra Gjæslingerne til Nordöerne og Kalvö, scale 1 : 50,000, 1904, *price kr.* 1.00; B 48, Den Norske Kyst fra Tjötta til Dönna, scale 1 : 50,000, 1905, *price kr.* 1.00. Specialkarter over Havne i Finmarken, Blad iii., iv., v., 1903–04, *price* 1.00 *kr. each sheet*. Christiania: Norges Geografiske Opmaaling. *Presented by the Institute Géographique de Norvège.*

PHOTOGRAPHS.

Colorado. **Jackson.**

Twelve photographs of Colorado, taken by W. H. Jackson. *Presented by Sir Joseph Hooker, G.C.S.I., C.B., F.R.S.*

This is an excellent series of large photographs measuring 17 × 22 inches, taken by Jackson of Denver, Colorado, about thirty years ago. They are printed direct from the negatives, and are not enlargements. They are splendid representatives of the grand mountain scenery of this part of Western America.

(1) Georgetown; (2) Uncompagre mount; (3) Great Morainal valley on the Arkansas at mouth of La Plata; (4) Lake San Miguel; (5) Mount Harvard; (6) View on Lake Fork, looking up Snare creek; (7) View near the head of the Lake Fork of Gunnison river; (8) The Upper Twin lake; (9) Baker's park and Sultan mount; (10) Lake San Cristoval; (11) Grey's peak from Argentine pass; (12) The Highland Mary Mining Works, Baker's park.

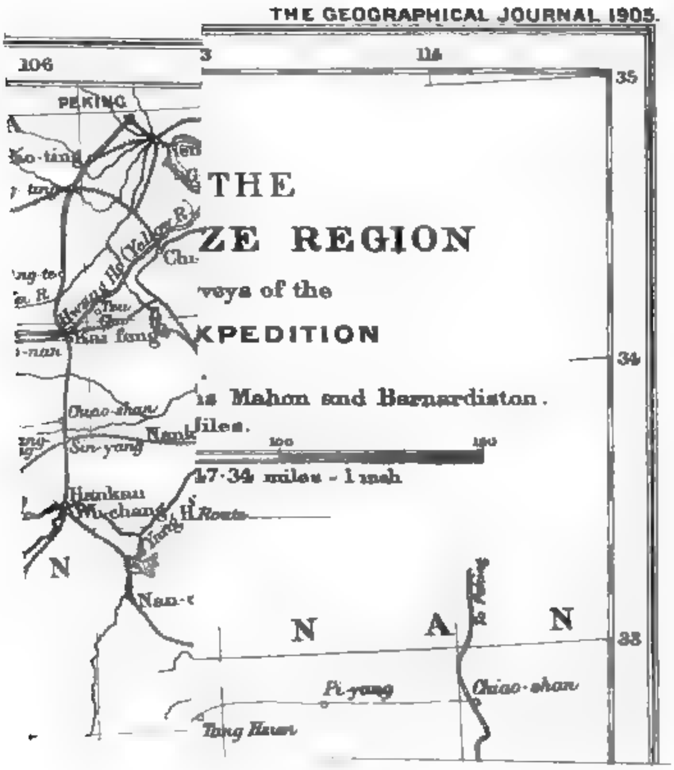
Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Dritte Reihe, Heft 1. Blumengärten der Ameisen am Amazonenstrome. Von E. Ule. Jena: G. Fischer, 1905.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

UPPER YANG-TZE REGION

MANIFOLD.



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For List of Council and Officers, Conditions of Admission to the Fellowship of the Society and Society Notices, see pages ii., iv., vi., and viii.

The Geographical Journal.

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ROYAL GEOGRAPHICAL SOCIETY.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £2 as annual "subscription for the current year, and thereafter a yearly subscription of £2, due on the 1st January "of each year; or he may compound either at entrance by one payment of £35, or at any subsequent "period on the following scale, provided that there shall be at the time no arrears due by him to "the Society:—

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The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's Office, 1, Savile Row, London, W.

ROYAL GEOGRAPHICAL SOCIETY.

NOTICES.*

Meetings in June.—**Monday, June 5.** Exploring Journeys in Asia Minor. By Colonel P. H. H. Massy.—**Monday, June 26.** The French Antarctic Expedition. By Dr. Charcot.

Conversazione.—The Annual Conversazione will be held in the Natural History Museum, South Kensington (by permission of the Trustees), on Tuesday, June 27, at 9 p.m. Tickets and programmes will be sent to Fellows.

The Year Book.—The Year Book for 1905 is nearly ready, and can be obtained by any Fellow by applying personally or by letter to the Chief Clerk, 1, Savile Row, London, W.

Notice to Fellows in Arrear.—The Council desire to intimate that the Society's publications will not be forwarded to Fellows who are in arrear with their subscription for six months or over.

Any Fellow resident in this country, desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2s. per session.

The Society's House will remain open for the Convenience of Fellows on the evenings of the Society's ordinary meetings till 8.15.

* See also pp. vi., viii. and x.

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs which has been established in the Map Room of the Royal Geographical Society, if all the Fellows who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they would be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A Reeves, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director-General of the Geological Survey.

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Zoology. By Dr. R. Bowdler Sharpe, Natural History Museum, South Kensington.

Anthropological Measurements. Under the superintendence of Dr J. G. Garson, Anthropological Institute.

Photography. By Mr. John Thomson, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. Mill.

Outfit and Health. Dr. Charles F. Harford, Secretary of the Travellers' Health Bureau.

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JUNE, 1905. VOL. XXV. No. 6.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

SUMMARY OF CONTENTS.

(For Details, see over.)

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PUBLISHED MONTHLY. (To Non-Fellows, Price 2s.; 27s. per annum, post free.

For Notices as to the Society's Meetings and other important matter, see p. iv.

Intimation of a change of address must reach the Office of the R.G.S. not later than the 15th of the month.